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THE DEVELOPMENT OF BRITISH SURGERY AT THE FRONT.

BY

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AND

COLONEL CUTHBERT WALLACE, C.M.G., A.M.S.,

CONSULTING SURGEONS, BRITISH ARMIES IN FRANCE.

It is not possible in a few pages to do full justice to the developments of British surgery during the war, but it is reasonable to place the more salient facts on record, and to summarize, however briefly, the present position of surgical work in the British Expeditionary Force in France and Belgium.

The Regimental Medical Officer.

It is unnecessary to write at length on the work of the regimental medical officer, for his duties in this war are much the same as they have ever been. He shares the dangers common to the combatant officers and men, and stays with his battalion or brigade, as the case may be. His treatment can only be that of first aid, but he and his orderlies have saved innumerable lives, both by the rescue of wounded comrades from dangerous situations and by careful and rapid transport to the field ambulance sections in the support line.

The Field Ambulance.

At this, the "advanced dressing station," there is a personnel of two or three medical officers, non-commissioned officers, and orderlies, and it is here that the first-aid dressings can be supplemented by additional dressings and by suitable splints, so as to ensure a more easy transit to the "tent section" of the field ambulance, a mile or two further back.

The field ambulance has not needed to undergo any very radical changes during the war, because its constitution and personnel proved it to be thoroughly well suited to its duties. But its surgical equipment has been very greatly improved and increased, so that it is in all respects well supplied for the performance of any urgent operation undertaken for conditions which do not require that the patients should be retained for any length of time.

The following instructions, which are amongst those issued in all the "armies" at the front, will best indicate the limitations of their work:

"(1) Only operations of emergency should be performed in field ambulances, but the following exceptions must be noted:

"(*a*) Completely smashed limbs should be removed, and the patients retained for at least a day before being sent to a casualty clearing station.

"(*b*) Haemorrhage should be arrested by ligature of bleeding points whenever possible. If this is not possible, then plugging or direct pressure on the wound itself should be resorted to. Patients should never be sent down with tourniquets on their limbs.

"(2) Abdominal wounds and all severe cases requiring early treatment at a casualty clearing station should be sent there by a special motor ambulance direct from the advanced dressing station. They should not be kept waiting for the regular convoys."

A further development of the tent section resulted from the conditions at the battle of the Somme, where, on account of the small area and the few good roads, "corps dressing stations" were created by joining up some members of the staffs of various field ambulances, so as to supply tent accommodation for a thousand or more wounded, with a staff of about thirty medical officers. A unit such as this performed the duties ordinarily performed by several separate field ambulances, and proved very successful as well as economical in medical officers and orderlies.

Motor Ambulances.

It is unnecessary to write much on a subject which is already thoroughly well known to all, but it is the supply of motor ambulances alone that has enabled us to deal adequately with the surgery at the front. One aspect of this subject, however, is very commonly overlooked, namely, the use of motor transport in saving the wounded from capture, for there can be no doubt that, had motor ambulances been supplied in large numbers, the tale of British prisoners after Mons and Le Cateau would have been very small. The first complete convoy came to the front in the middle of October, and at the first battle of Ypres was of the utmost possible value, both in getting patients quickly to the casualty clearing stations and also in saving wounded from falling into the hands of the enemy during our retirement to the ground we subsequently held.

The motor ambulance, indeed, is the very foundation on which all our surgery at the front is based. Without it the whole system would break down, for no horsed vehicles could possibly deal with the numbers of a heavy fight unless they were so numerous that they would practically block the roads for all other transport, and even then their slowness would result in such delays in delivery that surgery would be of little use. In addition, the well hung and well driven motor causes the patient infinitely less distress than the old ambulance wagon, and so delivers him in a much better condition for recovery.

The Question of Time.

This is a matter of so much importance to surgery that it is well to explain the time that is required to take a patient from the front trenches to the casualty clearing station. It is, in the first place, not sufficiently realized that the chief cause of delay, if it occurs, is "the enemy," for there have often been, and there still are, localities from which the wounded can only be moved under cover of darkness, so that a man may have to be kept in a dug-out the whole of a long summer's day before he can be carried to the rear. Again, in the desert of mud behind the firing line on the Somme stretcher-bearers sometimes took hours to carry a wounded man at night for several miles to the nearest point to which, in the absence of all roads, an ambulance wagon could approach. In yet other cases men lie out in the open ground on the so-called "No Man's Land" for many hours, or even for several days, before they are rescued. But supposing that none of these difficulties exist, the time occupied is very short, for, if communication trenches are good, and if a man is able to walk, he will often get to the advanced sections of the nearest field ambulance within an hour. If the communication trench is long and muddy, it may take twice that time. If he has to be carried it may take another half-hour or more, but as soon as he has got to a good road another hour will see him safely delivered to the place where his injuries can be thoroughly treated and where he can be well nursed under excellent conditions.

All this is comparatively simple if no great battle is in progress; and as great battles occur at infrequent intervals, it is evident that in most parts of the line of trenches evacuation is easy and rapid except for unusual local conditions. But in very heavy fighting, and especially when troops are advancing, it is often impossible to find sufficient stretcher-bearers in proportion to the great numbers of wounded, for only a limited number are attached to each regiment, and it is therefore necessarily true that the greater the number of the wounded who have to be carried, the longer must it be before the last of them can be brought in. No work is heavier than stretcher carrying for long distances and on difficult ground; and as men become exhausted their pace becomes slower, and they are obliged to rest at more frequent intervals. But even when all difficulties have been surmounted and the patients have arrived at the tent sections of a field ambulance, there are many who are too much exhausted for further immediate moving; and while the staff may have their hands full with dressing the wounded, they have also to care for the needs of the many men who need to be rested, fed, and warmed. While they are thus engaged on these patients, all those who require urgent treatment by operation have been taken direct to the casualty clearing stations, and thus have avoided delay.

The speed with which even patients who have to be carried can be brought in is best shown by taking the case of a consecutive series of abdominal wounds at one of the more advanced units. The following are the figures, and they show both how quickly men can be brought in when there are no unusual difficulties, and also how long it may be before a man can be rescued when an attack has been temporarily driven back.

Time of Evacuation to Casualty Clearing Station.

Under 3 hours	24	78 in first 6 hours.	134 in first 12 hours.	169 in first 24 hours.
Between 3 and 4 hours ...	20			
,, 4 and 5 ,, ...	24			
,, 5 and 6 ,, ...	10			
Between 6 and 9 hours ...	34	56 in second 6 hours.		
,, 9 and 12 ,, ...	22			
Between 12 and 18 hours	25	35 in second 12 hours.		200
,, 18 and 24 ,, ...	10			
Over 24 hours	31			

THE CASUALTY CLEARING STATIONS.

The development of the casualty clearing stations has been the most important factor in the creation of a new school of surgery at the front, and it is not too much to say that they have saved many thousands of lives which would have been lost but for the surgical opportunities which they have provided.

Before the war the "C.C.S.'s," as they may be named for brevity, appeared only on paper and as untried units, for they did not exist at the time of the South African war. They were originally called "clearing hospitals," and their proposed function was merely to clear the field ambulances and pass the patients on to the base hospitals. Their equipment, therefore, was only very slight, and their staff of eight officers, including the command officer and the quartermaster, was less than the staff of a field ambulance. They carried 200 stretchers, and were supposed to be able to deal with the same number of patients.

It is not necessary to enter into details to show how the six casualty clearing stations, which came with the original Expeditionary Force, were overtaxed, for, in spite of this, it became very evident during the first battle of Ypres that the casualty clearing stations might well be made the nucleus around which to build an efficient organization for much more complete surgical treatment than had been contemplated when they were first planned. The first change was the supply of bedsteads and bedding and the appointment of trained nurses; the next was the addition of more surgical equipment in the way of instruments, splints, sterilizing apparatus, etc. The selection of special surgeons was a natural consequence, and before the end of the year 1914 good surgical work was being done at eight centres. Since that time there has been further development and progress, and by the end of 1916 more than fifty casualty clearing stations were at work.

These hospitals, for such we can call them, are situated behind the line of trenches along the entire front, and certain local conditions are essential for the success of their work. First, they must be at or near to railway sidings, so that evacuation by train is easy. Secondly, they must be where good roads can connect them with the front. Thirdly, they must have a good water supply.

They are arranged in practically two series: (1) Those nearest the front are at a distance of from six to nine miles from the front trenches; (2) those of the second line are from three to six miles further back, and act as a reserve during active operations, or as units for special cases during quieter times.

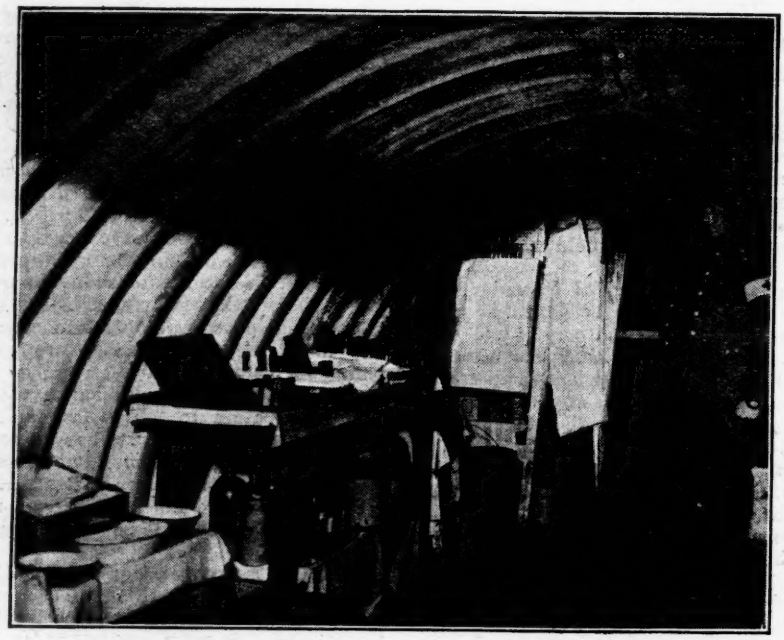


FIG. 1.—Interior of regimental aid post.

The casualty clearing stations vary greatly in their accommodation, according to the size of the buildings they may occupy, or to the amount of ground available for huts or tents when they are encamped. The smallest accommodate 400 to 500, and the largest from 800 to 1,200. Their staff is reinforced, as may be required, from other casualty clearing stations less actively employed, and from the staffs of the field ambulances.

Wherever possible the casualty clearing stations at the front are linked in pairs, and take in the wounded alternately. In this way it can be arranged that, after admitting as many as can be adequately treated, the wounded are diverted to the other casualty clearing station, and the staff is left free to treat those they have admitted, without being disturbed by fresh arrivals.

Operating Theatres.

When a casualty clearing station is housed in buildings these theatres must, of course, vary in size with the accommodation afforded. In the hutted or tented hospitals, however, which are the most numerous, the operating theatre is a hut about 60 ft. by 20 ft., giving space for four tables, and for sterilizing and store rooms. Large theatres are essential in dealing with large numbers.

The Treatment of Wounds in the Casualty Clearing Stations.

It is the object of every casualty clearing station to treat and retain all patients until they can be safely sent down by ambulance train. In times of comparative quiet there is no difficulty in attaining this ideal, and consequently, whatever standard of treatment is required from the surgical standpoint can ordinarily be attained. In times of heavy fighting, and especially when there is the certainty that many more wounded will arrive during periods extending over days or weeks, it is evident that the provision of empty beds necessitates sending patients away who might, with advantage, be retained a little longer. This pressure, however, does not prevent the performance of all really necessary operations, and these are now always performed. If the requirements of our army did not place a limit on the number of surgeons, nurses, orderlies and patients who can be retained in close proximity to the fighting line, there would be no reason why all patients should not be kept near the front, but it must be clearly appreciated both that there is this limit in every war, and also that casualty clearing stations are maintained everywhere in as great numbers as the military authorities can permit. It must also be remembered that if many hundreds of patients were kept in every casualty clearing station the staff of nurses and orderlies would be so much occupied in dressing and caring for them that they would not be free to attend to the wants of the recently wounded men coming in convoys from the field ambulances.

For more than two years it has been the deliberate policy of the British Army Medical Service to make the casualty clearing station the chief place for the treatment by operation of the dangerously wounded man who requires prompt treatment, rather than the field ambulances. The latter is too mobile and too frequently moved a unit to be thoroughly well equipped surgically, and, in addition, it

has been proved to be much better to move a patient before an operation to a place where he can be kept and nursed for several days rather than to move him directly after he has been operated upon.

Dressing and Distribution of the Wounded at a Casualty Clearing Station.

It is now the custom of all casualty clearing stations to dress their patients in large reception huts or tents as soon as they arrive, and to distribute them from this place in three classes: (1) For immediate evacuation; (2) for retention; (3) for operation. In the first class are included chiefly the slightly wounded. In the second class are patients suffering from shock, from the effects of bleeding, from wounds of the lung, from exposure to cold, etc. In the third class are all serious wounds of the soft tissues which require thorough dressing, and especially lacerated wounds due to shells and bombs; most fractures; many injuries of vessels; all perforating abdominal wounds, etc.

The proportion of cases requiring operations to the whole number of wounded will depend on many conditions—for example, the larger the proportion of shell wounds to bullet wounds the larger is the number requiring operation, and if a train is waiting to go to the base, men may be sent by it who would require operation if they had to be kept for thirty-six hours. But it may be stated in general terms that the proportion of patients treated under anaesthetics may be as high as one in four, but is more often about one in six.

The following table, compiled by Captain Hey, who is the Surgical Specialist at one of the forward casualty clearing stations, will give a very good idea of the operating work of a particular unit, and it includes a period of heavy fighting during a recent battle:

Table of Operations Performed at a Casualty Clearing Station.

A. Ligature of arteries:	
Carotid	5
Vertebral	2
Subclavian	2
Axillary	15
Brachial	39
Radial	18
Ulnar	8
Ext. iliac	2
Femoral	51
Popliteal	31
Ant. tibial	16
Post. tibial	58
Various	30
	277
B. For treatment of fractures:	
Skull	189
Vertebrae	18
Humerus	298
Forearm	133
Femur	299
Leg	309
Jaws	38
Various	119
	1,403
C. For treatment of joints:	
Knee	183
Other joints	64
	247
D. Amputations:	
Shoulder joint	14
Upper arm	77
Forearm	31
Thigh	186
Knee	10
Leg	76
Ankle	6
Various	31
	431
E. For drainage of pleura	49
F. For wounds of the abdomen	106
G. Removal of testis	33
H. For ruptured urethra	9
J. Enucleation of eye	43
K. Plastic operations	33
L. Tracheotomy	17
	280
M. Excision and cleansing of wounds:	
Head and neck	95
Trunk	309
Upper limb	249
Lower limb	765
Multiple	398
	1816
N. For conditions not due to gunshot wounds:	
Appendicitis	34
Strangulated hernia	1
Cellulitis	53
Various	13
	101

It will be seen that the total number of operations performed for gunshot wounds amounts to 4,554, and the total number of wounded admitted during the period in question was 20,589 in this particular unit. It will be noticed that a very large majority of the operations were for fractures of the limbs and wounds of the soft tissues which required complete surgical clearing. The proportion of abdominal operations would have been higher but for the fact that an "advanced operating centre" was near at hand, and took charge of many cases of this class.

During heavy fighting, operating work such as the above goes on continuously day and night, and consequently necessitates relays of surgeons, nurses, and orderlies. The work is exceedingly trying, and it must be reckoned on that not a few of the staff will be more or less knocked up after three or four weeks of it. But it is also quite certain that the early and thorough treatment of a very large proportion of all wounds has done more than anything else to save both much suffering and many lives.

ADVANCED OPERATING CENTRES.

It has sometimes been found that difficulties of locality have prevented the placing of so large a unit as a casualty clearing station exactly where its position should have been when heavy fighting has been expected, and in such cases a smaller unit has been placed so as to deal with the most urgent cases, and especially with those which required prompt operation. These small special hospitals of fifty to sixty beds have done excellent work, and a very large proportion of their cases have been abdominal wounds. The large number of the casualty clearing stations has prevented any necessity for creating many such units, for the casualty clearing stations are usually as well placed as is the special hospital, and the greater number of all the abdominal operations have been performed in them.

SPECIAL HOSPITALS.

Special Hospitals for Head Cases.

Operations for wounds of the head are dealt with in a subsequent section, and all that need be said here is that it has been found advisable to retain a considerable number of these cases near the front either in stationary or general hospitals, or else in a casualty clearing station of the reserve. They do not need the immediate operations required for abdominal cases, and are consequently provided for further back.

Special Hospitals for Shell Shock.

It is very desirable to remove such cases from the sound of shelling, and, as they require special treatment for some time, they also are dealt with in the rear of the front line of casualty clearing stations.

Special Hospitals for Diseases of the Skin.

These deal mainly, but not exclusively, with scabies, and the work is usually undertaken by the casualty clearing stations of the second line.

Stationary Hospitals at the Front.

A few of these units, which normally belong to the line of communication, also find a place at the front. So much of the work which would previously have been done in them is now performed by the casualty clearing stations that, in proportion as the latter have increased, the need for the stationary hospitals has diminished. Those that are at the front are commonly engaged more in the treatment of the sick than of the wounded, or else in treating some special class of case, such as injuries of the head or shell shock.

X Rays.

At the beginning of the war *x* rays were not supplied at the front, but, coincidently with the development of operating work in the casualty clearing stations, the need of these became apparent. At first mobile *x*-ray vans were supplied, but, as demands for these increased, it became necessary to supply stationary plants as well, more especially to those casualty clearing stations to whose share it fell to do most of the operations; and, not only have *x* rays been of great service in guiding the operator, but in many of the abdominal wounds where the missile has been retained they have been of the greatest service to the surgeon in deciding whether or no operation should be done at all. In many other cases, such as some of the wounds of the head or of the knee-joint, it has been found better not to undertake an operation without a preliminary *x*-ray examination, so that in the present stage of development of surgery at the front the *x*-ray plant has become essential for the work of the casualty clearing stations.

Anaesthetics.

At the beginning of the war chloroform was in general use, but it was evident that there were many objections to its universal application, and other agents were soon employed as well.

Ether has been largely used, and was formerly administered by the open method, but experience has shown that it is often inadvisable to use it thus because of its tendency to irritate the air passages. For at least six months of the year the men who are exposed to the wet and cold in the trench area are suffering in very large numbers from catarrhs of varying degrees of severity, and in many of them these are accentuated by the further exposure which follows on a wound, especially when a man falls or lies in mud or water. The result is that the administration of any anaesthetic commonly sets up so much bronchial irritation that the patient's life is endangered by an attack of bronchitis or bronchopneumonia. These complications are specially dangerous in cases of abdominal wounds where abdominal respiration is difficult and where coughing up of mucus is often impossible because of pain or intestinal distension. It is indeed a fact that a very large proportion of all the deaths following abdominal wounds and operations are due to lung complications, and these injuries are at least twice as fatal in the winter as in the summer.

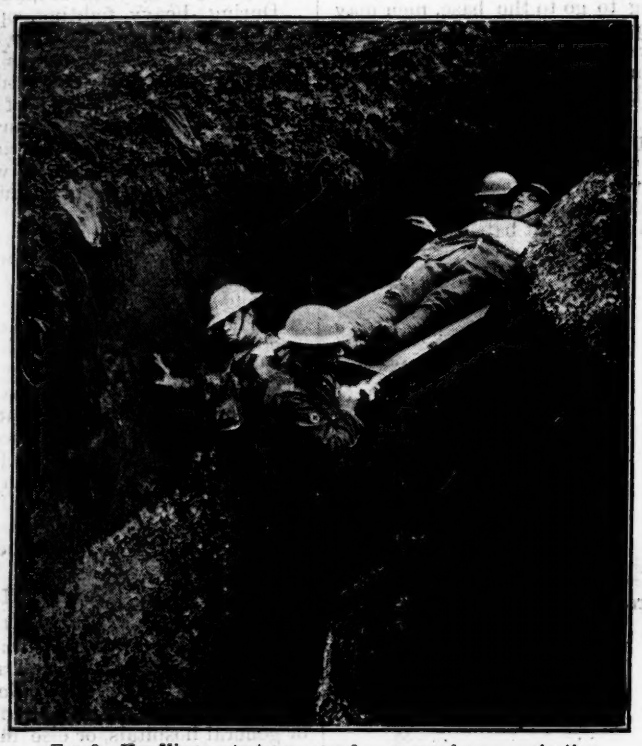


Fig. 2.—Handling a stretcher round a corner of communication trench.

Dr. Shipway's apparatus for the administration of warm ether vapour has been of the greatest value under those circumstances, and it is in common use in all the clearing stations. We have found that it possesses the following advantages:

1. There is very little secretion of mucus or saliva, and the patient is very quiet during the operation.
2. There is less sickness, probably because of the lessened quantity of mucus swallowed.
3. There is much less tendency to bronchitis and pneumonia.
4. The ether used is not more than one-third of that employed by the open method, and, as a consequence, it bulks less largely in transport.
5. Patients suffering from shock or haemorrhage can be pulled through an operation with less collapse than by other methods.
6. It can be connected with an oxygen cylinder, and the ether vapour can be administered in combination with oxygen in cases of shock.

The subject of the administration of anaesthetics at the front is decribed more fully in the paper by Captain Geoffrey Marshall printed on a later page.

The Use of Antiseptics.

It may be stated in general terms that it is the custom at the front to use antiseptics in the treatment of wounds, both at the field ambulances and the casualty clearing stations. No attempt is made to use antiseptic agents to disinfect the wounds on the field at the time of injury, for all who know the character of the wounds and the conditions of the wounded men, are agreed as to the complete futility of all such efforts, even if this had not been completely demonstrated during this war. But experience has also shown that in France and Belgium the wounds are so heavily infected from the soil that it is most necessary in all but the smallest wounds to excise very freely all the exposed and torn tissues which have been killed or else partially devitalized by the injury, and which are ingrained with dirt or portions of clothing. If this treatment is not carried out very thoroughly and carefully, and if free drainage is not secured, the gravest forms of sepsis may commence in serious wounds in a very few hours. It is common experience that if a badly wounded man cannot be rescued and brought into the field ambulance until after the lapse of twenty-four or thirty-six hours, the wound is often already so badly infected and the patient himself is in so toxic a state that surgical treatment has but little chance. It may be said truly that the most important alteration in treatment since the early days of the war is that excision of damaged tissue has become the routine method and that the earlier it is carried out the more likely it is to be successful.

"*Eusol*" and "*Dakin's Fluid.*"

Very many antiseptic agents have been employed, and there is naturally some diversity of opinion as to which is the best. There is no doubt, however, that at the present time hypochlorous acid in the form known as "eusol," or the hypochlorite of soda in the solution known as "Dakin's fluid," are more extensively used than any others. The method of Dr. Carrel has been increasingly employed for the past year, and wounds treated in this way have done exceptionally well, although it is not always possible to employ the method universally at a time when the wounded are in very great numbers. At other times there is no difficulty, and in order to establish continuity of treatment Dr. Carrel's method is freely employed on every ambulance train taking wounded to the base hospitals.

Hydrogen Peroxide.

This is not highly esteemed as a potent antiseptic, but it is of great service in loosening adherent dressings, and so preventing pain and injury to the soft tissues by forcible separation of gauze or wool.

Carbolic Acid.

At an early stage of the war, and in consequence of representations made by surgeons in England, attempts

were made to sterilize recent wounds by pure carbolic acid. They entirely failed to achieve this object, but solutions of a strength of 1 in 20 or 1 in 40 are in common use, and many surgeons have had a very favourable experience in using equal parts of solutions of carbolic acid and hydrogen peroxide.

Sodium Chloride.

The hypertonic salt solution has not proved successful at the front, and at the present time is hardly used at all. The wounds treated by it were usually very slow in healing, and the granulations were generally pale, flabby, and much overgrown. There has also been a good deal of evidence to show that secondary haemorrhage is not nearly so frequent an occurrence since hypertonic saline has been displaced by other antiseptics. This is not at all surprising when it is considered that rapid cicatrization is the best safeguard against this complication.

The salt pack largely used at Rouen is also to a great extent supplanted by the employment of "eusol" and "Dakin's fluid." It is, however, at the front a useful method of treatment of large open wounds in patients who are in transit by train. It does not need to be disturbed for several days, and when there are large numbers of wounded to dress this is a very great advantage.

B.I.P.

The mixture of bismuth subnitrate, iodoform, and paraffin, recommended by Professor Rutherford Morison for suppurating wounds (B.I.P.), has also been used for the past few months on recent wounds of the soft tissues, and also in cases of fracture. The results have been good, and encourage the further use of this remedy at the front. The fact that the wounds do not need dressing for several days gives it the same advantage as the salt pack, while its use permits of an early closure of the wound, and this is an additional advantage.

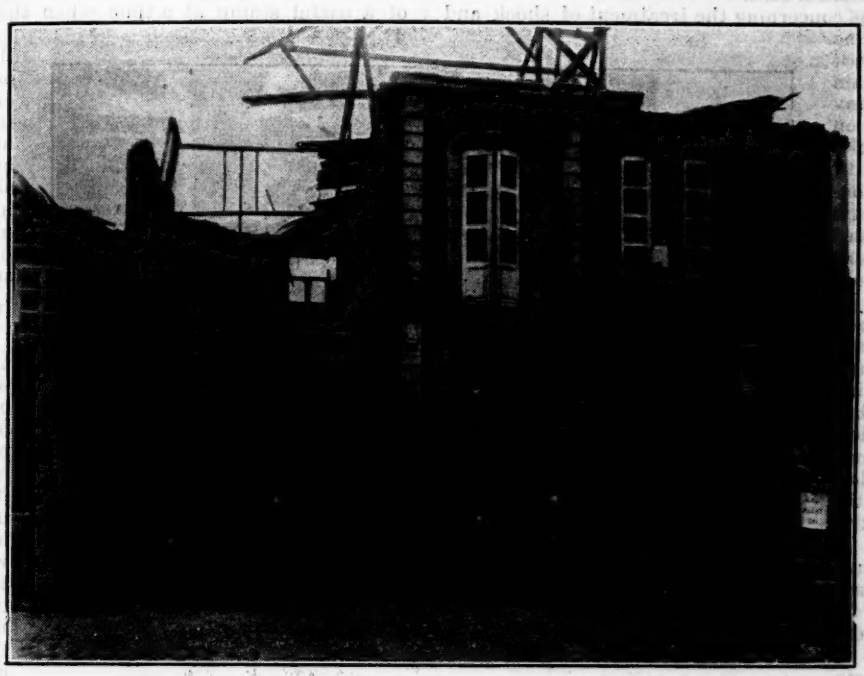


FIG. 3.—Advanced dressing station of field ambulance.

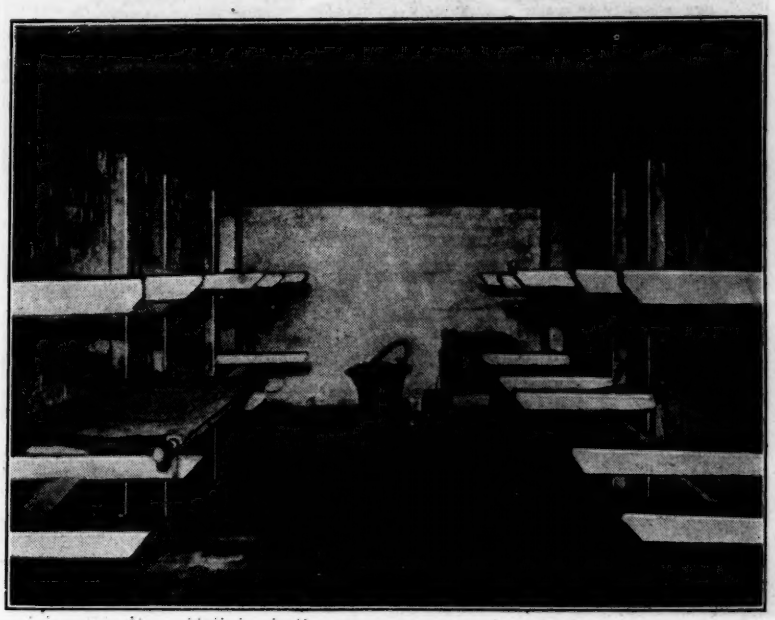


FIG. 4.—Interior of advanced dressing station.

SHOCK, AND THE CONDITION OF WOUNDED MEN.

The condition of wounded men necessarily differs as wounds are more or less severe, but in even slightly wounded men there may have been much bleeding, exposure to cold, want of sleep, or want of food. If to these are added severe pain and the exhaustion due to a hazardous journey over broken roads, it is easy to appreciate that very many patients arrive in a state bordering on collapse. Experience has shown, as a result of knowledge of these conditions, that it is not possible to estimate accurately the real condition of the patient until he has been rested and warmed, and has taken food; and especially in winter time the most important of these remedial measures is undoubtedly warmth. This may be applied by warm blankets after the removal of wet clothes, or by hot bottles. But in more severe cases we employ a "light bath" of electric lamps beneath a cradle, or else a "hot-air bath" extemporized by leading under the bedclothes a pipe connected with a primus stove. Hot liquid food is good if the patient can take it, but he is often nauseated or actually sick in the worst cases of shock, and then small enemata with brandy are very useful. Warmth and rest are, however, of more importance than nourishment, and if the patient goes to sleep, as he very often does, it is best to leave him undisturbed for some time.

PRIMARY AMPUTATIONS.

Unless a man is bleeding it is usual to treat him as has just been described before any operation is performed, but it is often necessary to postpone amputation for as long as a day, or even two days, if the removal of the limb is to be done at the thigh. Many men will survive if they are allowed sufficient time to get completely over the shock of the injury and its attendant conditions, who would certainly die if subjected to immediate operation, and the more experienced the surgeon the less is he likely to hurry on a severe primary amputation.

It is, of course, evident that delay in removing a badly smashed limb may result in dangerous sepsis, and there is no doubt that the threat of gas gangrene may necessitate operation earlier than might be wished. Much must therefore of necessity be left to the discretion of the surgeon in

each case, and, as it is only after a considerable experience at the front that really sound opinions can be formed, it is very necessary that those who have not had this experience should seek the advice of those who have before a decision is come to in a doubtful case.

Other questions concerning the treatment of shock and the use of saline infusions are dealt with in Captain Marshall's communication on anaesthetics at the front.

When the condition of the limb and of the patient permit, a primary amputation should be performed by one of the recognized methods practised in the usual circumstances of civilian surgery, suitable flaps being provided. It is, however, never right to neglect drainage of the stump, and this should always be secured by the use of a large drainage tube, at any rate for a period sufficient to ensure that no serious sepsis exists.

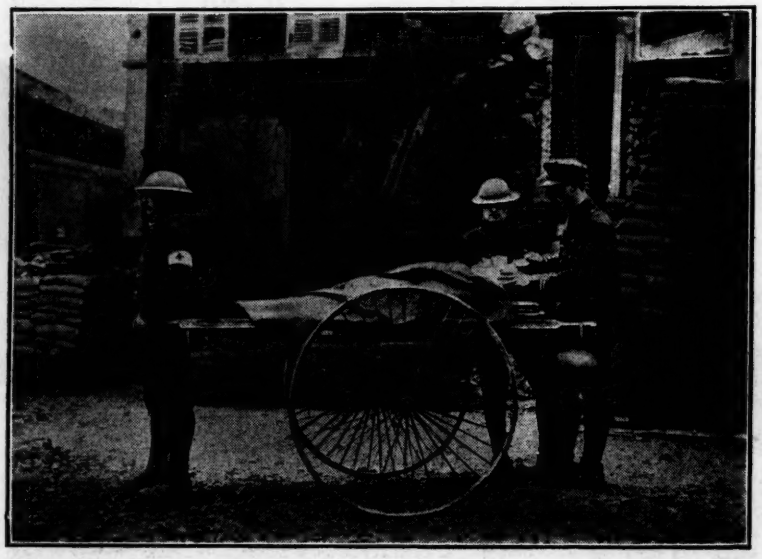


FIG. 5.—A wheeled stretcher.

The seat of amputation has been much discussed, but in our experience the best general rule is that as much of the limb as possible should be saved, quite regardless of the typical "seat of election" as prescribed in former years; primary amputations through joints are, however, as a rule to be avoided.

Departure from these ideals may be necessary, either because of the condition of the patient himself or of his limb.

If the patient is desperately ill from the combined effects of loss of blood and other complications his condition may be such that the additional shock of a high amputation may be quickly and inevitably fatal. In a pulseless patient who has a numbed and still oozing limb the best thing is to remove it as quickly as possible by cutting through the soft tissues at the site of fracture, subsequently clipping away torn and ragged tissues and tying the main vessels.

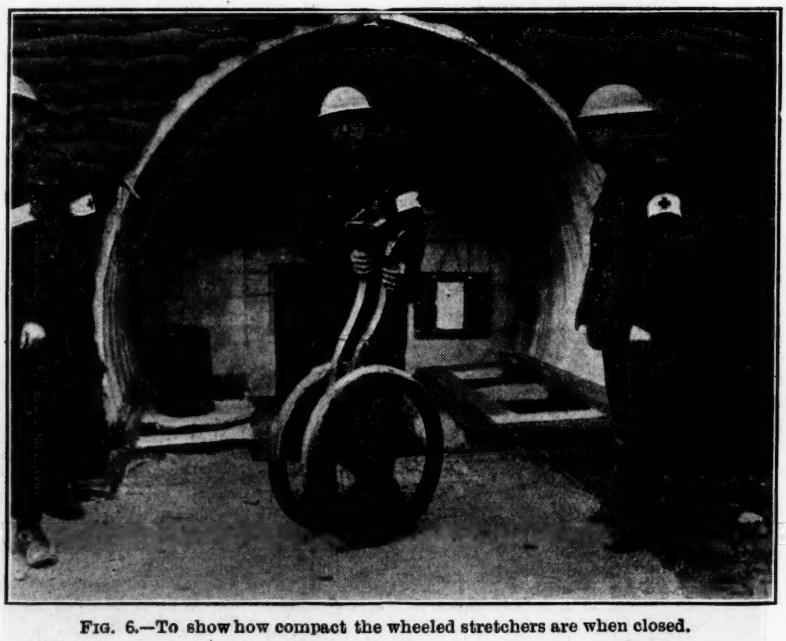


FIG. 6.—To show how compact the wheeled stretchers are when closed.

Not more than ten minutes need be spent on such an operation, and, if it is conducted under the influence of gas and oxygen anaesthesia, many apparently hopeless cases can be saved, for there is very much less shock than would be entailed by either a longer operation or by the cutting though healthy and sensitive skin and muscle higher up the limb In such a case the making of a suitable stump must be left to a future time.

In another class of case the leg or the forearm may be smashed beyond recovery, while the thigh or the upper arm is the seat of other severe wounds complicated by the presence of mud, of portions of shell, or of clothing. It is quite unwise in such a case to amputate high up the limb, and it is best to perform a "flush amputation" close above the fracture, and again leave to the future the formation of a useful stump at a time when the damaged tissues have recovered. If this is not done, not only is the patient exposed to more severe shock by a high amputation, but his stump may slough and a yet higher up removal may be necessary if he ultimately does survive.

WOUND INFECTIONS.

It is well known that in France wounds are liable to be very heavily infected by numerous pathogenic organisms, and inquiry from surgeons who have had experience in other theatres of warfare enables us to say that, especially in Egypt and in the Dardanelles, the gas gangrene and tetanus infections were notably much less common than they are in France.

While no time of year or condition of weather brings immunity, it is very evident that wet weather and mud are far more dangerous than summer weather and dust; and this danger is much increased when patients are wounded in very cold weather and are thoroughly chilled before they can be brought in. Most surgeons are also agreed, that the coldness and lowering of vitality caused by severe haemorrhage have a similar predisposing effect on microbic infection, and it will be found that wounded men are attacked by tetanus and gas gangrene in proportion as the various conditions exist which are inimical to the human organism. It has also been noted that gas gangrene has often affected wounds in patients who have subsequently developed tetanus also.

GAS GANGRENE.

This disease appeared very early in the war and was a very unpleasant surprise to the surgeons. It had not been described as a usual complication of gunshot wounds, and though seen occasionally in civil life, so that its etiology was known to a certain extent, it was sufficiently unfamiliar to render an accumulation of experience necessary for its proper treatment.

Two clinical types of the disease were recognized early and were named "gaseous cellulitis" and "massive gas gangrene." The former term was applied to the milder cases in which the cellular tissue round the wound was considered to be the primary seat of the disease; the latter

term to those cases in which the whole limb was rapidly affected and died. The milder type of the disease was treated by incisions and drainage, the severer type by amputation.

From a clinical point of view it was found that the conditions that favoured the onset of the disease were: (*a*) The retention of extravasated blood and wound secretions, (*b*) interference with the circulation, (*c*) the presence of large masses of partially devitalized or dead tissue, (*d*) extensive comminution of long bones, (*e*) the presence of particles of clothing in the depth of the wound. Each of these observations was quickly turned to account in the treatment of cases in which the disease might appear.

FIG. 7.—Overhead railway ambulance trolley.

RETENTION OF BLOOD AND SECRETIONS.

The avoidance of the retention of blood and secretions necessitated the employment of some sort of dressing that would not dry and cake during the transit of the patient to the casualty clearing station and from there to the base. Thus the dry gauze and wool dressing was abandoned for one that would keep moist and favour the discharge of blood and serum. It did not seem to matter what chemical was used so long as the dressing remained moist.

INTERFERENCE WITH THE CIRCULATION.

Interference with the circulation was brought about in several ways. First there was the tourniquet. Every effort was made to dispense with this instrument, and where this was not possible the patient was taken with all celerity to the nearest place where the haemorrhage could be stopped. Circular bandages were found also to be a source of trouble, especially when the bandages took the form of a gauze dressing wrapped round and round the limb, which mode of application was very tempting in treating multiple wounds.

FIG. 8.—Two light railway ambulance trolleys.

In simple flesh wounds it was easy to arrange that the bandages and dressings should be loosely applied, but in the case of fractured lower limbs it was necessary to obtain some fixation of the limb, for the movement of the bones was not only painful to the patient, but calculated to produce further damage to the soft parts. The adoption of the Thomas splint largely solved this part of the problem, but there were and still are difficulties in the way of its adoption as far forward as is desired. Some fractured lower limbs are still sent to the casualty stations with the old Liston splint; the rapid evacuation of all wounded that now pertains has, however, lessened considerably the disadvantages of this splint.

The arrest of the blood supply to a segment of a limb by the rupture or thrombosis of an artery has so far baffled the surgeon. Attempts were made by suture and the employment of Tuffier's tube to restore the circulation, but, so far, have not met with the success that was hoped. All that can be done is to favour the collateral circulation in every way.

DEVITALIZED TISSUE.

The devitalized tissue that formed a nidus for the development of the gas-producing organism was got rid of by excision through the opened wound, and as the attention paid to this mechanical cleaning of the wound became greater so did the results improve.

BACTERIOLOGY.

While surgeons were working out the best methods of treatment the bacteriologists were studying organisms found in the wounds, which were nearly all infected with many varieties of amoebic bacilli. Many bacteria were found, but the blame could not be definitely fixed on any one organism, and in many cases there was a mixed infection. The *Bacillus aërogenes capsulatus* of Welch was found present in the greater number of cases. The interesting and important observation was, however, made that the numbers of gas-producing organisms steadily decreased with the lapse of time, whilst the pus-producing organisms increased. This bacteriological fact corresponded with the clinical observation that the likelihood of gangrene occurring became steadily less as the wound became older and suppuration more obvious.

Our knowledge of the disease, both from a bacteriological

and clinical point of view, remained much in the above condition for a long time. The following points were always being debated:

(*a*) What were the organisms capable of producing the disease?

(*b*) Could any one bacterium alone cause the gangrene?

(*c*) If not, what mixture might be necessary and what part did each organism play in the clinical picture?

(*d*) What tissue was primarily and chiefly affected?

(*e*) How did the disease start, and what was the cause of the extraordinary rapidity with which the condition spread?

(*f*) What was the reason of the return of the disease after an amputation through apparently healthy tissue?

(*g*) What was the nature of the poison that caused the death of the patient?

FIG. 9.—Light railway stretcher carrying four wounded.

It cannot be said that a complete answer to any of these questions has been found, but some suggestive work has been done. For answers to the first three questions (*a*), (*b*) and (*c*), the reader is referred to the statement by Captain Herbert Henry, R.A.M.C., which will appear later.

In answer to the fourth question (*d*), Kenneth Taylor, a member of an American ambulance near Paris, stated that he believed that the disease was essentially a disease of the muscles. Some clinical observers working in the British army have supported this view It was found that gas gangrene seldom produced serious symptoms unless muscle was infected, and that the muscles might be killed and gaseous while the intermuscular planes remained little altered. It was also pointed out that single muscles and muscle groups were very apt to be picked out while others remained healthy. It was noticed that invaded muscles were nearly always muscles that had been wounded. The disease would spread up and down these, but showed little disposition to pass to their uninjured fellows. Advantage was taken of these facts to excise those muscles affected, and thus arrest the disease without recourse to amputation.

FIG. 10.—Outside an advanced dressing station. Each of such is marked with flags as shown.

It was further recognized that crepitations and colour changes in the skin might be comparatively late manifestations of the disease and that death of the muscles might take place before these signs were evident. Vomiting, a rapid pulse, and a tympanitic condition of the limb came to be more and more relied on as symptoms of the disease and as an indication for immediate interference. It became apparent that the discoloration of the skin was due to arrest of the blood supply, brought about by the death of the underlying muscles, and that crepitation was largely due to a forcing out of the gas generated in the muscles into the intermuscular planes and subcutaneous tissue, and that the crepitation in muscle was really a very late stage in the process of disintegration.

When gangrene occurs in a segment of a limb distal to the point at which the main vessel has been obstructed, all the muscles are affected, and the process appears to be similar to that which takes place in the body after death, though the actual route by which the organisms gain entrance is undecided.

As muscle became infected it was found that the normal purple-brown colour altered to a dirty brick red, and that this change took place before the muscle became crepitant to the finger. Advantage was taken of this observation to distinguish between healthy and hopelessly infected muscles.

In some cases the connective tissue was found to be the seat of the disease, especially the retroperitoneal tissue when infiltrated with blood.

Metastatic infections at the site of saline injection were described by McNee, Mullally, and other observers. This observation is important, for it may explain in part the return of the disease after amputation.

(*e*) When all wounds were infected by the gas producing organism, why should some pursue a normal course and others give rise to gangrene? If it is accepted that this disease is mainly one of muscle, some measure of explanation is afforded. The question still remains, Why do some muscle wounds lead to gas gangrene and others not?

Most observers believed that the organisms could only live in dead muscle. In every muscle wound there is dead muscle; but if the diseased condition should spread, the organism, on the assumption that the bacillus could only live in dead muscle, must be able to kill the muscle. How did it do this?

D'Este Emery, who had been impressed with the

repeated return of the disease in amputation stumps and its rapid spread, in a most suggestive paper showed that the poison produced by the *B. aërogenes capsulatus* had a powerful negative chemiotaxic influence on the leucocyte. These experiments performed *in vitro* were in strict consonance with the histological observation that there is no leucocytosis where gas gangrene is active, and that the leucocytes only appear when the disease is in process of arrest. D'Este Emery's observation appeared rather to explain the non-arrest of the disease than to account for its rapid spread.

Taylor thought that there might be two factors. In the first place, as the toxin produced by the organism was found to be little toxic, he suggested that the toxin elaborated by the breaking down of the muscle might cause the death of the contiguous muscle substance. He also suggested that the presence of the gas generated produced disintegration of the muscle, and thus made it a pabulum for the bacilli.

FIG. 11.—The ventilating shafts of an advanced dressing station.

McNee and Dunn have offered the following explanation:

The bacteria which are responsible for the causation of gas gangrene lead their normal existence as saprophytes in decaying organic material. When these organisms obtain access to tissues which have already been devitalized by loss of blood, they find an environment entirely suited to their growth, and proliferating readily, they produce gas and liquefaction of the tissues. This process is simply the uncontested invasion of dead material by bacteria, and it is entirely similar to what may occur in the whole body after death. The problem which has presented greater difficulties, and which possesses the graver interest, is the manner of involvement of living tissues by gas gangrene. The causal organisms are known to exhibit only slight general pathogenicity. If pure cultures of them are injected subcutaneously into animals the effects may be surprisingly slight and transient. The organisms are most frequently unable to establish themselves in the healthy undamaged tissue, and are soon destroyed by phagocytic action. The effect, however, is considerably greater if the bacilli are injected into muscle, and especially if some damage is caused at the site of injection. In this way the whole picture of a spreading gas gangrene has been produced in the leg of an animal by inoculation of a pure culture of the *Bacillus aërogenes capsulatus*.

FIG. 12.—Advanced dressing station. Where the patients are received.

The mere presence of the anaërobic bacilli in the muscle does not necessarily entail death of the fibres, for the organisms have often been recognized in sections, and have been successfully cultivated from portions of muscle which were remote from the gangrenous area and still contractile. How, then, does death of the fibres arise?

The rapid spread of gas gangrene into living voluntary muscle depends mainly on the peculiar anatomical conformation of that tissue. At the advancing edge of the gangrenous process only a limited number of muscular fibres are necrosed. The dead fibres, in contrast with the normal ones around them, are separated off from their vascular sheaths by spaces filled with fluid. As the stripping of these sheaths is coincident in extent with the histological appearance of coagulation in the fibres, it is suggested that coagulation is caused by a toxic fluid permeating and filling the sheaths. At this stage organisms are not more numerous than may be found in living muscle higher up. The toxic material is presumably derived from the action of organisms on the tissues lower down. In a slightly more advanced stage the above alteration is found to extend to all their fibres and their sheaths, and bacilli are met with in greater numbers. Later still the whole of the tissue elements are invaded by the bacilli, and undergo extensive distortion and disintegration.

The above outline suggests a process which, once started, may maintain itself indefinitely, for the progressive death of the muscle permits further luxuriant growth of the organisms and extension of their lethal effects. The sugar content of muscle is favourable to the growth of the anaërobes, and the result is the production of a highly toxic fluid. The primary infection no doubt occurs in the wound in lacerated ends of fibres which are healthy in the rest of their length, and the establishment of a gangrenous process is permitted by this continuity of structure.

RECURRENCE AFTER AMPUTATION.

(*f*) In discussing the question why the disease sometimes recurs in an amputation stump when the operation has been done through apparently normal muscle, it seems necessary to distinguish between two types of amputation:

1. An amputation through the upper healthy part of muscles, the lower portions of which are gangrenous.
2. An amputation through muscles which are normal throughout their length, as in removal of the thigh for gangrene of the leg.

McNee and Dunn have shown that the *B. aërogenes capsulatus* is found in healthy contractile muscle far beyond the gangrenous edge. As the only clinical test we have of healthy muscle is its normal colour and its contractility, it may happen that an amputation through such muscle may still leave numbers of bacteria in the stump.

This explanation does not seem sufficient. The fact that metastatic infections appear from time to time shows that bacilli may be floating in the blood. Should this happen in a case submitted to amputation it is possible to conceive that they may find a resting place in the muscle damaged by the amputation and thus start the disease afresh.

(*g*) At present the nature of the poison and its mode of action are unknown.

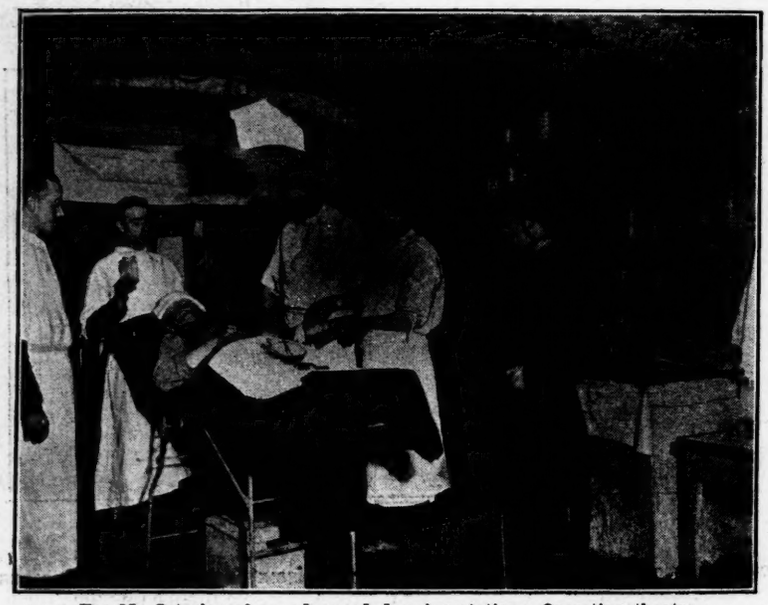


FIG. 13.—Interior of an advanced dressing station: Operating theatre.

TREATMENT.

The treatment in vogue at the present moment, and based on the above observations, may be summarized as follows:

Preventive.

The wounds are opened up and all dead tissue and foreign bodies removed and adequate drainage provided. The circulation is encouraged in every possible way.

When the Disease is Established.

(*a*) When gangrene appears in a segment of a limb where the main blood supply has been interrupted higher up the only treatment is amputation.

(*b*) When the gangrene appears in the muscles or muscle groups actually wounded. Here the treatment must depend on the condition of the patient. If this is good the wounds are freely opened and the affected muscles or muscle groups removed. The test employed to distinguish dead from healthy muscle is the want of contractility or the presence of the brick-red colour.

Even with the gangrene localized to certain muscles amputation is the safest course if the general condition is bad, and it is seldom possible to save such a limb if the bone is broken.

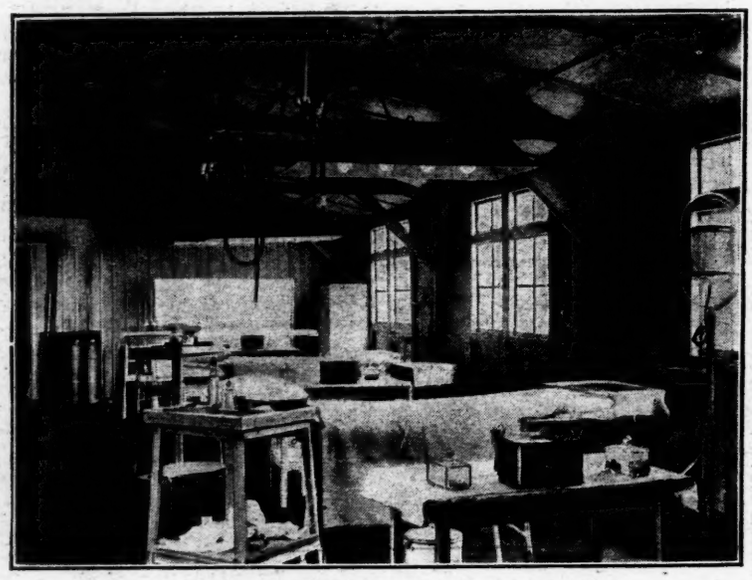


FIG. 14.—Operating theatre at a casualty clearing station.

ABDOMINAL WOUNDS.

SURGICAL OPINION WHEN THE WAR STARTED.

For many years it had been held that the operative treatment of abdominal wounds was not to be advised under war conditions. This was partly due to want of success, as in the Spanish-American war, and partly to the fact that many military surgeons were opposed to extensive operating anywhere near the firing line; as abdominal surgery, to be successful, must be done at once, it is obvious that it could not be undertaken with success where all operations had to be postponed to a late period. Although the expectant treatment was the orthodox one when the South African war broke out, many surgeons at that time hoped to prove that it was wrong. Surgeon-General W. F. Stevenson even issued an appeal for the trial of operation. The result was, however, only to confirm former opinion, though this opinion was now held on two somewhat different grounds. One school held that the expectant treatment was in itself the right procedure, the other that it was the best that could be done in war.

Some believed that wounded intestine healed sufficiently often to warrant abstention, others believed that small gut lesions were practically always fatal, and that the success obtained by the "wait and see" policy was due to the escape of the bowel from injury, although the belly had been penetrated. The opinion that it is possible for the small gut area to be traversed by a rifle bullet without injury has been proved to be correct in this war. A study of the literature of the South African war, both private and official, makes the real reason for want of success in operating at once obvious—the cases arrived too late. It was not so much a question of the success of the expectant treatment as failure of the operative, and the two strikingly successful cases of resection of small gut (Neale and Tuke) were operated on within six and twelve hours of injury respectively.

The reason for the late operation was the nature of fighting in an unsettled country of great distances. The wounded could not be quickly brought to a hospital with the necessary appliances. To operate in the veld with what appliances were at hand was too disheartening. It was impossible to get even moderately good conditions. There was little or no water, and what there was was often too filthy for words—the water of dams. In addition, there was the plague of flies that settled on everything.

The conditions were utterly different from those that pertain at the present time. This is the first time since the rise of abdominal surgery that a great campaign has been fought in a settled country, and, what is more important still, with a fixed fighting line.

The small number of cases dealt with in the South African campaign was also a source of error, for in order to form an adequate idea of the efficacy of any treatment it is necessary to strike an average over a large series of cases.

The statistics of the South African campaign are very defective. Surgeon-General Stevenson in the official history of the war was only able to collect 207 cases of abdominal wounds. Among them it is stated that there were 26 laparotomies with 18 deaths, a mortality of 69.2 per cent., and according to Stevenson the mortality was really even worse. The total death-rate of all abdominal wounds quoted—operated and unoperated—is given as 30.4 per cent.

In the same author's most recent work, *Wounds in War* (1910), the mortality is shown as 51.6 per cent. for laparotomies, the total of cases remaining the same—namely, 207. In any case the figures are really too small to have any real value.

In this present war one of the difficulties of establishing the operative treatment was the run of bad luck which any operator might have to face. Even now, with conditions as nearly ideal as possible, a series of nine consecutive fatal cases may be met with. This must have a very depressing effect on any surgeon, especially on one who is not yet convinced that the operative treatment is in the main the best of all. Now nine abdominal cases means roughly about 600 wounded men, taking a moderate estimate of the proportion of abdominal wounds to total wounds.

As a matter of fact, in the South African campaign a casualty list of 600 wounded was considered a large one, and if an operator happened to encounter such a series of fatalities, it is not a matter of surprise that he should have had doubts as to the correctness of his procedure.

Statistics in the present campaign show that an operative mortality of 50 per cent. is a good result, but such a mortality in civil practice would be considered an awful death-rate to face. And yet it means, looking on the bright side, many lives saved.

The South African campaign may, then, be said to have left surgical opinion opposed to operation, but it must always be remembered that not only were there practically no shell wounds in that campaign, but also that the ogival bullet was a much less harmful missile than the sharp-pointed bullets of the present war.

Method of Treatment in the Earlier Period of the War.

In the retreat from Mons and on the Aisne adequate provision for the performance of abdominal operations near the front was well-nigh an impossibility, and all that could be done was to send the wounded to the base with the least possible discomfort to them. When, in the ensuing winter, the line became fixed the circumstances were very different, and there soon developed a possibility of operating under good conditions. It was no longer a question of whether a man could be operated upon, but whether he should be operated upon. Still, however, a good deal of the old belief in the efficacy of the expectant treatment obtained for some time longer. A man wounded in the abdomen was sometimes kept in a dug-out in the trench system; often he was kept at a field ambulance, usually he was transferred to the casualty clearing station and there treated.

The customary mode of procedure was to put the man in the Fowler position, to improve the general condition by rest and warmth, to withhold food and water for three days and to administer morphine. The thirst, which was a distressing symptom of this treatment, was combated to a certain degree by rectal salines and mouth washes.

A tribute must here be paid to the great care and attention which the medical officers lavished on the patients. Certain officers were told off day and night to attend to them and everything possible was done to alleviate their suffering and to make them as comfortable as possible and to cheer them up. If anything could have got these men well the attention that they received would have done so, and it must be remembered that the medical officers who conducted the treatment were convinced of its efficacy.

This belief was strengthened by the behaviour of many of the patients, for some who were at first gravely ill, went through a period of improvement which often was very striking. It was in a way unfortunate, but there is no doubt that improvement did take place, and so well were many of them that after several days they were evacuated to the base and arrived there sometimes in fair condition, although more often gravely ill. But the surgeons who had seen the cases leave the casualty clearing stations apparently on the way to recovery could not at first bring themselves to believe that they did badly at the base, and if evacuation had not been necessary and it had been possible to keep patients at the casualty clearing stations the expectant treatment would not have survived as long as it did, for medical officers would have seen many such cases become worse and worse, and in the end—die.

Commencement of the Operative Treatment.

Although rest treatment was the rule, some attempts at operation had been made as early as November, 1914; but it was only when the more complete development of the casualty clearing stations provided satisfactory conditions that surgeons felt that their opportunity for operating had arrived, and during the winter of 1914–15 operations were done by several medical officers. But the early results were undeniably bad—so bad that most people abandoned the attempt, and the reasons for failure were no doubt both the late arrival of the patients at a place where an operation could be performed and the want of knowledge which later on was acquired by experience alone, for there was no literature which dealt with such injuries as the surgeons were now called on to treat, and each man had to learn the best methods for himself.

Owen Richards was the first to publish results of operative treatment in the British army.[1] His first operation was performed on January 28th, 1915, and the first successful operation, that of a resection of 2½ ft. of the small intestine, was performed on March 18th, 1915, thirty-six hours after the injury was received.

In May, 1915, an inquiry into the causes of death after abdominal wounds established the following facts:

1. That the injuries were as a rule of such a nature that recovery must be a very rare event.
2. That haemorrhage was a chief cause of early death.
3. That bullets produced very extensive injuries.

It had always been granted that haemorrhage was the chief cause of early death, but the advocates of expectant treatment seem to have focussed their attention more on the danger of peritoneal infection and the possibility of its localization or disappearance than on the possibility of spontaneous arrest of haemorrhage.

The discovery that bullets produced extensive gut injuries was also of great importance, as much stress had been laid on the smallness of the lesions produced by the modern small bore bullet, and the expectation of spontaneous recovery of gut lesions had been based on the quite erroneous assumption that such projectiles were comparatively innocuous.

The re-establishment of the fact that haemorrhage was the chief cause of early death was of great importance, as it showed that only rapid evacuation afforded any hope of combating such a condition. Arrangements were accordingly made to ensure that all patients suffering from abdominal wounds, and who were not too ill for transport, should be sent by special motor ambulances to the clearing station and not retained in the field ambulance. At the same time meetings of the medical officers of field ambulances and regiments were held at different centres, so that it could be demonstrated to them that the lesions of the hollow viscera were much more extensive than they had believed, and that in such conditions early operation gave the only chance of recovery. The result of this diffusion of more accurate knowledge was soon seen in the much earlier arrival of patients, and the greatest praise is due to all those who combined in the effort to rescue the men and convey them to the rear as rapidly as possible. The consequences of these improvements soon became apparent in the saving of many lives, and the operative treatment, now that it was placed under favourable conditions, very soon won for itself the confidence of the medical service, and quickly became universally adopted.

Where to Operate.

The British practice has been to operate a short distance behind the line, and the wisdom of this has been demonstrated. Here it is possible to operate under good

conditions and to nurse the patient among cheerful surroundings for a week or more subsequently.

The casualty clearing stations have, as a rule, been used for this purpose. If for some local reason it has not been possible to put one sufficiently far forward at any one part of the line, a small operating centre has been opened for

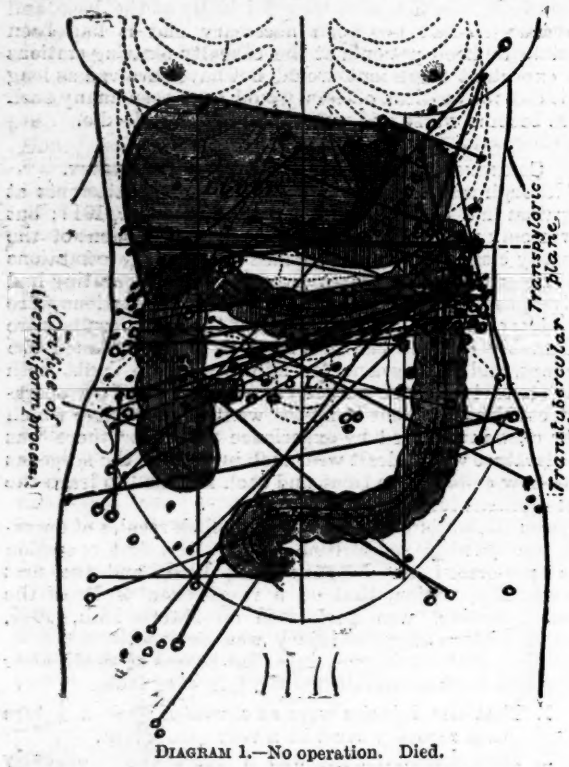


DIAGRAM 1.—No operation. Died.

the reception of abdominal and other urgent cases. The influence of time is shown very clearly in Table I.

TABLE I.—*Effect of the Time Elapsed between Receipt of the Wound and Arrival at the Operating Centre.*

Total number of cases 591.

Hours:	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20	Over 20
To base ...	3	30	75	55	34	19	7	4	11	4	27
Died ...	2	30	53	59	41	23	10	12	15	11	56
Total ...	5	60	128	114	75	42	17	16	26	15	83

A very significant fact comes out from a study of the next table (II)—namely, that of 145 patients with a pulse above 120 only 16 recovered.

TABLE II.—*Prognosis from Pulse-rate.*

Total number of cases 577.

Pulse up to:	60	70	80	90	100	110	120	130	Over 130
To base... ...	1	7	23	30	108	27	37	7	9
Died	1	2	13	18	39	38	88	37	92
Total... ...	2	9	36	48	147	65	125	44	101

Table III shows that bullet wounds are highly fatal.

TABLE III.—*Relative Mortality of the Different Projectiles.*

Total number of cases 629.

	Bullet.	Shell Fragment.	Shrapnel.	Bomb.
To base	91	105	15	60
Died	106	154	40	58
Total	197	259	55	118

TABLE IV.—*Relative Number of Different Projectiles and Proportion Retained.*

Total number of cases 834.

	Bullets.	Shell Fragments.	Shrapnel.	Bombs.
Passed out ...	203	30	15	6
Retained	131	254	67	128
Total	334	284	82	134

The Most Dangerous Wounds.

The chart (Diagram 1) shows the entrance wound or the course of the projectile in cases that arrived too bad for operation.

Possibility of Escape of Hollow Organs after Penetration of the Abdomen.

Diagram 2 shows the course of the projectile or its place of entrance in those cases in which coeliotomy proved that no hollow alimentary viscus had been penetrated. In some such cases many organs were bruised.

A certain number of cases of rupture of a hollow viscus without abdominal penetration have occurred, and have made it advisable to explore the intestine in some instances even when the whole thickness of the abdominal wall was not penetrated by the missile, but where the symptoms have pointed to the probability of a lesion of one of the hollow viscera.

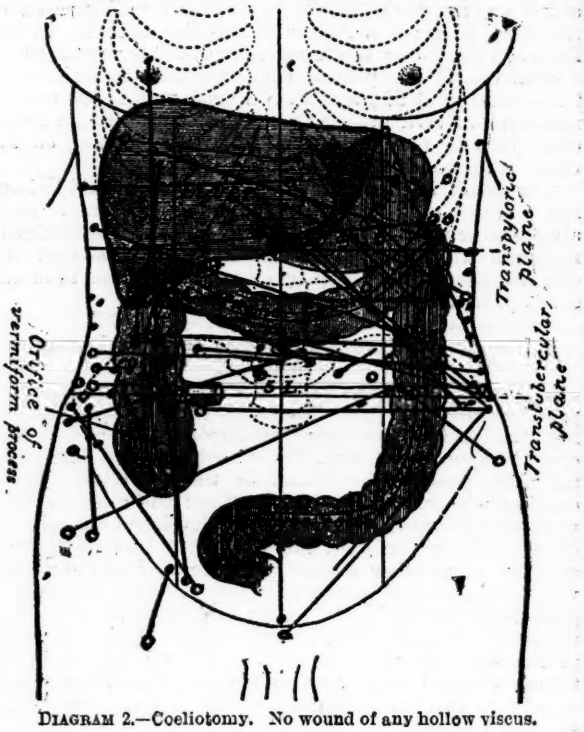


DIAGRAM 2.—Coeliotomy. No wound of any hollow viscus.

General Line of Treatment.

The practice is now to operate on all cases unless there is some reason to the contrary, and to operate on principle rather than on the indications by symptoms.

The cases on which operation has been found, as a general rule, to be inadvisable may be divided into two classes—(1) those in which solid organs alone are wounded and in which there are no signs of continuing haemorrhage, and (2) cases arriving after thirty-six hours.

The liver furnishes by far the greater number of cases in Class (1). This organ is the only solid organ in which it is possible to say from inspection that no other organ is wounded. In the other solid organs, such as the kidney and spleen, the likelihood of hollow visceral injury nearly always compels exploration. Were it not for this contingency, the solid organs would require little operative attention.

In Class (2) the time for successful interference in the

case of hollow viscera has as a rule gone by, and the bleeding, from whatever source it came, has ceased spontaneously.

Before operation a period of rest has found favour with most people. This period is used to combat shock, for which purpose heat in various forms has proved by far the most efficient means.

When the missile is retained the position of the projectile should be ascertained by an *x*-ray picture, as its localization will influence the site of the exploratory incision. The incision should as a rule be placed by the side of the mid line and be of ample length. A transverse incision is much favoured by some for exploring wounds which traverse one side only of the body.

The question of the administration of saline is important. The subcutaneous injection of saline has found favour in the past, but it is coming to be recognized that very little is absorbed in a shocked man, and that this method presents no advantages over its administration by the natural orifices. If these are not available the intravenous method should be used.

Axioms of Operative Procedure.

Celerity is of great importance. The body heat must be preserved in every way. There should be the least possible exposure of the viscera, and the intestines should be kept inside the abdomen as much as is compatible with the necessary manipulation. The least possible should be done. All the intestine should be examined. Suture of the intestine should always be preferred to resection unless the latter is inevitable, or saves time, and experience has shown that a single continuous suture, applied so as to invert the peritoneum, is quite sufficient and perfectly secure. Linen thread or thin silk are both preferable to catgut, and care is required not to draw the stitches too tight. If resection is unavoidable, end-to-end anastomosis is preferable to lateral apposition as a rule.

Solid organs should be disturbed as little as possible, unless vessels have been opened. Excision of spleen and kidney should be practised with great reserve.

Through-and-through wounds of the liver are best left alone, but if the *x* rays show a large piece of shell or bomb in an accessible position it should be removed, for if left it generally causes dangerous sepsis in the organ.

Abdominal drainage is most probably of little use except in local lesions.

Artificial anus in the colon are to be avoided if possible.

Wounds of Special Organs.

Stomach.—Wounds of the stomach, though less severe than those of the small and large intestine, have proved decidedly more dangerous than was supposed. The fatal result has largely been caused by haemorrhage and shock and by complication with other visceral injury.

Small Intestine.—In the small intestine the multiplicity of the lesions and haemorrhage from the mesentery have been the chief causes of failure. As many as twenty lesions have been met with. In one case a successful result followed a resection of 6 ft. for twenty perforations (Captain Owen Richards). In another case fourteen lesions were sutured and followed by recovery (Captain John Fraser).

Large Intestine.—The large intestine wounds have been mostly fatal from sepsis of the retroperitoneal tissue in the case of the ascending and descending colons and from complicated injuries in the case of the transverse colon.

Rectum.—The rectum proper has not been wounded so often as would be expected, but has a high mortality.

Liver.—The liver shows a large proportion of recovery after operation, but many patients would have got well without operation.

Spleen.—The spleen injuries have not been very dangerous except where the lesions have necessitated excision, and the same may be said of the kidney.

Bladder.—Intraperitoneal wounds of the bladder show a mortality of 56 per cent. where uncomplicated, but those associated with small gut injury have proved exceedingly dangerous.

Causes of Failure.

Haemorrhage, sepsis, and shock have been the chief causes of death.

Haemorrhage has come from every vessel in the abdomen except the aorta. Principally it has proceeded from the mesentery and the pelvic vessels. On two occasions a rent in the vena cava has been closed—in one by the application of forceps (Captain Taylor), and in one (by Captain Sampson) by suture. The former recovered. In one instance the vena cava was ligated, but the patient survived only ten hours.

Sepsis.—Under this head are included peritonitis, retroperitoneal sepsis, and wound infection. It is unnecessary to say much about peritonitis. It causes death in the same way as seen in civil practice. Many attempts have been made to combat the so-called obstructive symptoms by enterostomies and short circuits, but with little if any success. It must be mentioned here that a certain amount of evidence has accumulated showing that some obstructive cases have as their basis a nervous traumatic paralysis. Retroperitoneal sepsis, accompanied or not by gas formation, has proved a great source of mortality. This has been obvious in the case of the colon injuries, but a recent series of *post-mortem* examinations by Captains McNee and Dunn has proved that such sepsis is frequently the cause of death where that death has clinically been put down to shock.

Shock.—This subject is dealt with in another place by Captain Geoffrey Marshall, but a word may be added here. It is very difficult to trace any definite relation between the amount of injury and the amount of shock. It can only be said that multiple injuries produce, as a rule, much shock. A severe intestinal lesion will not in all cases prevent a man from completing the task on which he was engaged or even from walking one or two miles, and many who subsequently die arrive at the hospitals in good condition. The pulse-rate table gives some indication of the patient's condition. Prolapse of the small gut seems to cause less disturbance than that of the stomach and colon. Haemorrhage is by far the most frequent cause of death, and as it is nearly always present, it is difficult to determine how much shock is due to this cause and how much to the accompanying injury. There is a certain amount of evidence to show that comparatively slight injuries of both kidney and liver will cause intense collapse, but such cases are not common. Sepsis of the retroperitoneal tissue without severe injury does cause the most intense shock.

Results.

The following table gives the results obtained by the operative treatment in a certain sector of the British line over a period of eighteen months. Practically every case that got to hospital is included, so that a true picture is presented, and the varying results produced by locality and different conditions are eliminated as far as possible.

TABLE V.—*Abdominal Wounds operated on in a Sector of the British Line during Eighteen Months.*

Total number of cases	1,288
Arrived moribund	250
Total mortality, excluding moribund ...	50.06 %
Total mortality, including moribund ...	60.02 %
Considered with view to operation ...	1,038
No operation advised	73
Total operations	965
Total operative mortality...	53.9 %
Total hollow viscera mortality	64.7 %
*Stomach mortality	52.7 %
*Small gut mortality	65.8 %
*Colon mortality	58.7 %

* Uncomplicated by wound of other hollow alimentary viscus.

It is very difficult to compare the present mortality with that of the pre-operative period. The whole method of evacuation has completely changed. The operative treatment has attracted to the casualty clearing stations all men wounded in the abdomen, so that those who would have died in dug-outs, at the advanced dressing stations, and at the field ambulances, now reach an operative centre.

Neglecting the more forward positions, a calculation made in the pre-operative days showed that the mortality at field ambulances and clearing stations was 70 per cent. In addition there were the deaths at the base, which raised the mortality to about 80 per cent.

There would therefore seem to have been an improvement of from 15 to 20 per cent.

WOUNDS OF THE HEART.

There has been one successful suture of a heart wound. It was performed by Captain John Fraser. The details are as follow: A bomb fragment entered immediately internal to the left nipple. There was a persistent and pulsing escape of rather dark blood. A probe passed upwards and towards the mid line evidenced a cardiac rhythm. The pulse was small and irregular; the patient distressed and cyanosed. A portion of the fifth rib and its cartilage was removed, and the fourth costal cartilage detached from the sternum. The pleura and fat were retracted, and the pericardium incised. The latter contained a quantity of dark blood. A small hole, the size of a pea, was found in the right auricle. By a suture the auricle was pulled up into the wound and the hole closed by two linen sutures. The progress was good, and the pulse, which had been 120, dropped to 90 on the fourth day.

The patient nine months later reported his health as excellent.

WOUNDS OF BLOOD VESSELS.

It may in the first place be noted that the conception of many surgeons of the size of the lumen and of the thickness of the wall of arteries in general has undergone a change in this war, and it has often been remarked by medical officers that the arteries are smaller and have slighter walls than was expected. No doubt the class of subject from which one gained an idea of the size of the normal blood vessels is so different from the class met with in war surgery that there was an exaggerated idea both of the size of the artery and of the thickness of its walls in healthy young adults.

Surgeons, knowing that they would have to deal with healthy arteries, hoped that many opportunities would present themselves for arterial suture, but unfortunately the opportunities have been few, and the injuries have rarely been of such a nature as to offer any prospect of success or even of trial of such treatment. Lateral suture both of veins and arteries has been done in a fair number of cases, and in two instances a lateral rent in the vena cava itself has been closed, although the only successful case was one in which the sides were brought together by artery forceps and not by suture. The opportunity of end-to-end suture of arteries has rarely offered itself at the front, and as far as the writers know has only been even temporarily successful in one case, that of a bullet wound of the brachial artery; and this vessel gave way and formed an aneurysm some three weeks later. In a few cases the femoral artery has been sutured, but in no case has the operation saved both the limb and the patient.

Although so far the results have been disappointing, this is not a matter for surprise if the condition of the wounded vessels is examined. The class of case in which it was hoped to try this method at the front was that of open wounds such as are generally caused by shell; but unfortunately the ends of the artery are commonly so far apart that it is found that they cannot be brought into apposition after the necessary dissection of the vessel has been done. Even in the popliteal space, where some approximation of the arterial ends can be obtained by flexion of the knee, no case has yet occurred in which arteriorrhaphy has seemed feasible, while small wounds of the limbs or neck with an arterial haematoma seem hardly suitable for this method of treatment.

It was under these circumstances that "Tuffier's tubes" offered some hope of saving limbs from gangrene when arterial suture was out of the question. They have been employed at the front on many occasions, and are, it is believed, well worth trying, as, although they become blocked within about twenty-four hours, they have appeared to tide a limb over this the most critical period before the establishment of the collateral circulation. In one case it was noticed that the tube itself remained unblocked although the artery below became obstructed by clot, and it may be that this distal clotting in the artery will always be a difficulty in practical as opposed to experimental surgery. It must be remembered that in actual practice the limb below the lesion has been deprived of blood for some time before the opportunity occurs of inserting a tube and re-establishing the circulation, and it may be that this period of starvation produces changes in the vessel walls that favour clotting.

There is another observation which may have a bearing on this subject. In civil practice, after the interruption of the main blood supply of a limb and the consequent occurrence of gangrene in its lower part, one looks for and sees the formation of a definite line of demarcation. But in the present campaign it has been found that after the destruction and ligation of an artery this line of demarcation fails to appear in the majority of cases, and the seat of the amputation has to be chosen by noting the place where the limb becomes cold and discoloured, on the one hand, and, on the other, where the capillary circulation is still active, as shown by the return of the skin blush after pressure. No doubt the primary loss of blood has something to do with the frequency of gangrene in the first place, and in the second it would appear that the nature of the injury so upsets the blood supply of the limb that the collateral circulation is slow in being re-established, and that sufficient blood does not reach the part to bring about the rapid and healthy reaction that is necessary for the formation of a distinct line of demarcation.

It is a fact at once curious and important that the arrest of the blood current at a point that is considered a favourable one for the application of a ligature in civil practice is often followed by gangrene when that arrest is caused by a gunshot wound. It may be that the laceration of muscle that so often accompanies such injury is the cause to a certain extent, but there must be other factors at work, as gangrene may follow even a small perforating wound. Wounds of certain arteries stand out as especially dangerous to the vitality of the limb, notably those of the popliteal and the anterior and posterior tibials.

INJURIES OF JOINTS.

A great change for the better has taken place in the results obtained in the treatment of wounded joints.

Experience was chiefly gained on the knee-joint, for it is the joint most frequently hit, most easy of inspection, and its infection is followed by disastrous consequences more often than in the case of other articulations.

In the early days two lines of treatment were followed. The small perforating wounds were left alone and allowed to heal, the progress of the joint being tested by aspirations if necessary. The larger wounds with escape of synovia or actual laying open of the synovial sac were drained, and at first the drains were often introduced into the joint cavity. The results of this treatment were undeniably bad, and all sorts of heroic measures were adopted for the arrest of the septic processes which ensued. But continuous irrigation or an acute flexion of a widely opened articulation gave equally poor results, and the patient was lucky if he escaped with a stiff leg.

The first improvement was the abandonment of the intra-articular drains. The next was the excision of the wound, the removal of any foreign body, the flushing of the joint, and in some cases the closure of the capsule and the insertion of a superficial drain. Closure was especially advocated by Colonel Gray in the year 1915.

The next step was perhaps a bold one. As soon as possible after the receipt of the injury—that is, in the casualty clearing station—the wound was excised, the joint opened, cleaned, and irrigated, and then the whole wound in the synovial sac and the superficial tissues was tightly closed. It was certainly astonishing how seldom infection followed such treatment, even when fragments of shell or pieces of clothing had been removed from the joint; but for its success it is essential that the incisions around the wound edges should be carried quite clear of all infected tissue, and that the strictest asepsis is assured.

Now, every knee-joint with such a wound is given the chance of healing by first intention, although the closure of the joint defect may entail the performance of a plastic operation to provide an adequate cover with a flap of synovial membrane or skin. Even if some infection does follow the closure of the joint, it is well not to be in too great hurry to lay the articulation open, for a certain number of such joints do settle down and provide a better limb than if submitted to more active treatment.

When the joint wound is complicated with fracture of bone it may still be possible in some cases to close it with success. In cases of compound fracture of the patella with loss of substance, partial or complete

removal of the fragments, and the provision of a skin flap, will often be followed by primary healing.

When the tibia or femur are involved the case becomes more serious. Of the two fractures that of the tibia is the most to be feared.

In cases of only partial loss of the articular surface of either the tibia or femur, and also in linear oblique fractures of both bones running up into the joint, it is often worth while to try to close the joint and to obtain primary union.

Where there is much comminution of bone, however, and a dirty wound it is better to abandon all hope of saving the joint and perform a limited primary excision. After such an operation the joint surfaces are usually kept apart by extension on a suitable splint, and Carrel's treatment adopted until the wound cleans, when the bone surfaces may be allowed to come into contact.

The knee is the only joint in the body in which penetration of the synovial sac is at all commonly seen without damage to the bony constituents of the articulation. It is therefore not common to have the opportunity of closing other joints, but the opportunity should be taken when it is offered.

More often the surgeon has to treat a greatly disorganized articulation, and in such cases a primary excision is most probably the best course, especially in the case of the shoulder and the elbow.

The primary treatment of wounded joints may be summarized as follows:

1. Fixation on a suitable splint. In the case of the knee this splint should be one of the varieties of the "Thomas" as used for fractured thigh.
2. Beyond this treatment nothing more is required in simple perforating wounds.
3. The taking of an *x*-ray picture in cases where there is a possibility of the retention of a missile or of fracture of the bones.
4. The excision and cleansing of the damaged tissues and the exploration and lavage of the joint.
5. The closure, if possible, of the joint cavity.

HEAD INJURIES.

At the beginning of the war surgeons called upon to treat head injuries applied the ordinary rules of civil practice and operated on them at once. They were confirmed in their opinion that operation was right, since, apart from the mere physical defects, many patients seemed to be suffering from compression.

These operations were done both at casualty clearing stations and field ambulances, but the best method of operative treatment was as yet undeveloped, and the result was that many septic complications were seen at the base. Next, it was noticed at the base that cases which, from force of circumstances, arrived there unoperated upon, did better than those operated on at the front. This was attributed at first to faulty technique, and within limits this criticism was just, as the right operation was as yet undeveloped, both at the base and the front.

The observation was next made that if patients were kept quiet at the place where they were operated upon they did well, while cases operated on and apparently doing well were reported to have arrived in bad condition at the base when evacuated early.

It thus became obvious that there were two reasons for head cases doing badly: (1) The want of a good operation, (2) early evacuation of cases well operated on.

There were then two alternatives: The cases must be either operated on at the front and kept, or else evacuated as soon as possible to the base before operation; a patient must not be operated upon and evacuated forthwith. Two procedures were therefore adopted. In times of pressure head cases were cleaned up and sent to the base at once, provided they were fit to travel, and in quiet times they were operated on and kept at rest at a casualty clearing station for a week or ten days. Even this period of rest after operation proved too short, though the results were better than in earlier evacuation.

The next step was the establishment of special hospitals for head cases at the front. Advantage was taken of the fact that a head case before operation travelled well, and the special hospitals were placed in the back part of an army area. These hospitals were never subjected to the sudden pressure that may fall on an advanced casualty station, and consequently the cases could remain there for a long time. By this means patients experienced the advantages both of early operation and prolonged rest. The actual method of evacuation is as follows: The patients are brought from the trenches to the casualty clearing station as rapidly as possible. Here they are examined and dressed. If the pulse is slow they are sent on to the special hospital. If the pulse is rapid they are put to bed and evacuated later, should they improve. No special attention is paid to the type of wound—reliance is placed on the slow pulse as a sign that the patient will bear the journey.

The type of operation that has eventually been found most beneficial has been arrived at after many changes. Workers, comparatively far apart and not in direct communication, have evolved very much the same operation. At the front a small conservative operation was formerly practised which experience has shown to have been a little too limited in scope. At the base there were two schools—one favoured an extensive removal of bone and a scalp flap, the other an enlargement of the scalp wound and a limited removal of bone. Gradually the types of operations have approximated. It has been found that the removal of bone sufficient to expose half an inch square (1.27 cm.) of uninjured dura is best suited to most cases. Opinions still differ, perhaps, as to the comparative merits of making a flap or enlarging the scalp wound. On the whole, the flap is the best as a routine, unless the wound, as in the case of a horizontal one, is so situated as to compel the use of a very large one.

The recognition of the fact that a slow pulse is not necessarily a symptom of compression (for it may occur with a wide exposure of the brain), and that the symptoms, paralytic and otherwise, are not due to depression of fragments but to a destruction or commotion of the brain matter which is not remediable by operation, has also had an effect upon procedure. In the first place, a slow pulse is welcomed as a sign that recovery may follow, and it is not taken as a sign that operation is urgently needed, but rather that it is worth doing. The recognition that depression of fragments is not the usual cause of the symptoms has also done away with the notion that their removal must be immediately undertaken.

It is true that the sooner a dirty wound is cleaned up the better, but immediate operation is in many head cases followed by a great drop in blood pressure, so that some delay may be actually beneficial on this account, and Colonel Sargent has pointed out that for at least twenty-four hours after injury the brain is liable to be oedematous, and to extrude unduly if operated on while in this condition. A moderate delay has also been said to do good in that it allows adhesions to form between the dura and the pia mater, thus lessening the chance of a spread of infection over the brain surface.

At the same time that the best type of operation as regards the scalp and bony defect was being evolved many other points were in the process of settlement.

1. Excision of the wound was soon decided on.
2. There was at first considerable discussion as to how far the brain should be explored for bone fragments on the one hand and the projectile on the other. Every one was agreed that an *x*-ray picture had become a necessity, and the opinion was gradually formed that a limited and intelligent search for bony fragments and other foreign bodies was beneficial, but that attempts to reach a missile which was deeply embedded in the brain was not justifiable. Results seem to have proved the correctness of this line of treatment, for fragments of shell are reported to have caused little trouble provided their weight was not enough to cause pressure on the surrounding brain during movements of the patient.
3. The fact that many patients with head wounds suffered from septic complications, and the general demand for the drainage of all wounds, led at first to the employment of drainage in most cases of cranial surgery, not only of the scalp but of the brain also. The results of drainage of the brain were not satisfactory, and gradually it was abandoned, at any rate as a primary measure. The introduction of tubes was first omitted, and subsequently, systematic attempts were made to cover in the exposed brain, the scalp being brought together over the defect in the bone and dura, either by simple suture, pericranial flaps, or relieving incisions formed by undercutting the scalp. A drain introduced under the scalp is still generally

employed. This covering up of the brain seems to have been a decided success, and, although septic complications are still too often met with, they are less frequent than in former times. There has consequently been a great decrease in the number of cases of hernia cerebri.

4. There is still some difference of opinion as to whether small cranial depressions and linear fractures with slight inequality of surface, uncomplicated by symptoms, should be operated on in the first instance.

5. Most surgeons have accepted the recommendation of Sargent and Gordon Holmes that depressed fractures over the longitudinal sinuses should be left alone in the first instance.

6. Most operators are of the opinion that the dura mater should not be opened if found intact. The recognition that true compression of the brain is seldom seen has helped the formation of this opinion.

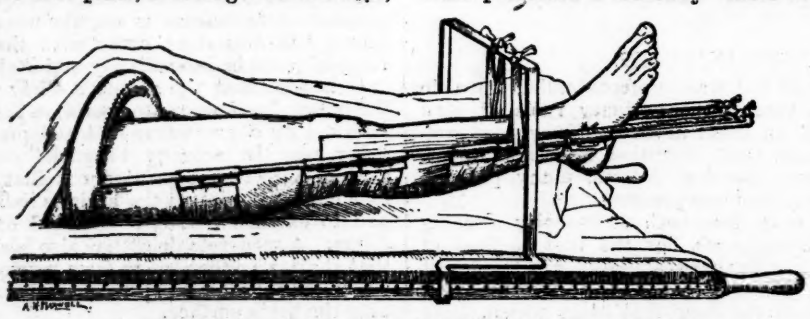
7. A general anaesthetic may with advantage be replaced by the local use of novocain and adrenalin. If this method is adopted the patient is given either hyoscine and morphine or omnopon and scopolamine an hour before the operation.

Thus, by careful individual observation, and by the comparison of results, a method of treatment has been evolved which is applicable to all cranial wounds, and capable of modification in individual cases. It may be summarized as follows:

A primary cleansing of the wound. The transmission of the patient as soon as possible to the hospital where he will convalesce. The taking of *x*-ray pictures. The excision of the scalp and bone wound. A limited and careful removal of foreign bodies. The covering of the exposed brain. The closure of the wound, with superficial drainage, and a prolonged rest in bed.

FRACTURES.

The tendency throughout the war has been to abandon all constricting splints and to trust to extension for fixation of fragments. In the first place, a bandage round a limb, which might from swelling or movement cause constriction, was found to favour the onset of gas gangrene, and in the second, the various forms of Thomas's splint, in which the limb lies on a cradle, gained more and more reputation as a means of efficient splintage. Few other splints are now used on the lower extremity. It is curious that while plaster splints, both as emergency contrivances and as a means of permanent fixation, have steadily increased in use in the French army, in our own they have as steadily fallen into disuse.



Fractured femur, with Thomas's splint and stretcher suspension bar.

The treatment of a compound fracture must be divided into two parts: (*a*) The cleansing of the wound; (*b*) the setting or reduction of the fracture, followed by its maintenance in good position. In the early stages the first is by far the most important, and on its attainment depends, within limits, the success of the second.

Total immediate reduction is good and to be aimed at, provided it can be carried out without prejudice to the cleansing of the wound, but an incomplete reduction, or even no reduction at all, may be advantageous by aiding the disinfection of the wound. Surgeons working at the front are therefore mainly concerned with the primary cleaning of the wound and with the means to transport a patient to the base with comfort and without detriment to the wounded limb.

The organisms that infect a compound fracture may be roughly divided into two classes: (*a*) Anaërobic or gas gangrene producing infection; (*b*) infection due to pus-producing organisms.

Anaërobic or gas gangrene producing infection affects chiefly the muscles, is sudden in onset and development, but tends to die out if not fatal in the early stages.

Infection by pus-producing organisms affects all the structures of a limb, is generally of slower development, and fatal at a considerably later period. The first (*a*) is the chief cause of death at the front, the second (*b*) of death at the base.

From the fact that it affects muscles, the first is more amenable to treatment by mechanical means—the excision of the affected part or part likely to be infected; but the second, giving little indication of its presence, cannot be so easily removed by such means.

At the beginning of the war fractures were treated very much as they were in South Africa. It is true that fragments of projectiles and clothing were removed, but more attention was paid to the solution of continuity of the bones than to the cleansing of the wound.

The occurrence of gas gangrene quickly called for a remedy, which was found in amputation or incisions into the limb. Then came the demand from the base for free drainage. At first small tubes were used; as these proved inefficacious, large tubes were substituted. At the same time came a more systematic search for foreign bodies. This produced an improvement, and it was reported that the cases that came down with adequate drainage, especially those with dependent drainage, stood a far better chance than those in whom such measures were not taken.

About this time attention was drawn to the fact that many flesh wounds, if freely excised, could be sutured with success. The application of this principle, though it could not be applied *in toto* to fractures, led to more extensive opening up and to better mechanical cleaning by the excision of all dead tissue and the more efficient removal of foreign bodies. These measures greatly reduced the occurrence of gas gangrene and produced an improvement in the suppurative infections. At the same time as these improvements were taking place in operative technique the adoption of the Thomas splint for the lower extremity in one of its many forms was steadily working its own good. The stretcher in the ambulance car and the cot in the train presented a difficulty—there was nothing on which to rest the splint. This difficulty was overcome by two methods. (1) A form of Thomas's splint (devised by Captain Max Page) provided with an attached foot-piece or prop was used so that the splint was raised off the stretcher and the limb lay slung, as it should, in the splint. (2) Two forms of iron bracket (devised respectively by Lieutenant-Colonel Frankau and Captain Richards), attached to the foot of the stretcher, allowed the Thomas splint to be suspended above the canvas of the stretcher.

Patients thus travelled easily in the motor ambulances, and the difficulty of the cot in the train was easily surmounted by sending the patient down on the stretcher. This latter expedient has been of great benefit to the wounded, as once placed on his stretcher at the casualty clearing station he can remain undisturbed until he reaches his bed at the base.

The fixation in a Thomas splint depends upon the extension. An efficient extension is therefore of prime importance. Sinclair's glue has provided the means. It is easily and quickly applied, and has the additional advantage that it produces no constriction of the limb. It has another advantage, it can be used when only a short portion of the leg is available, a very great gain when dealing with limbs covered with multiple wounds.

There are, of course, a few fractures of the femur that cannot be treated with Thomas's splint—namely, those in which a wound has been received on the part covered by the ring. For these the old Liston splint is used, or in some cases the abduction frame of Jones, though the bulk of the latter makes it unsuitable for work at the front.

Below the knee the Thomas splint can nearly always be used, except in those cases in which the fracture is near the ankle. Even here it is often possible to use it by the aid of the sole extension as devised by Sinclair.

In the case of fractures of the upper extremity the Thomas splint has not proved so satisfactory, but only for the reason that the straight posture of the arm is unsuited to transport except under special circumstances, as in transit by barge. The form of Thomas splint for the bent arm has not proved a success. For transport the form of internal angular splint, with a hinged back piece for the upper arm as devised by Captain Colin Clarke, is probably the best.

The development of the operative side of the casualty clearing station and the provision of *x* rays has been of inestimable benefit to the patient. There can be no doubt that the chance of the patient recovering with a good limb and of escaping a long period of suppuration depends on the attention that can be paid to his wound in the first instance. No amount of after-care can ever make up for the want of it at the first moment. A thorough and deliberate operation is all-important. There must be a free opening; the cavity must be explored by the eye, and not only by the finger, otherwise dead tissue and possibly foreign bodies will be passed over.

When first received, the wound is dirty, but the number of pus-producing bacteria is comparatively few. In a few days it is probable, no matter what treatment is adopted, that they will have greatly increased in number. If the first operation has been incomplete, a second may be necessary at the very time that the wound is in the worst possible state, and the procedure necessary to supplement the primary operation may be disastrous in exposing fascial planes to infection from a wound teeming with bacteria.

The early, deliberate and efficient cleansing of the wound is the basis of success, no matter what chemicals are used after it is completed.

REFERENCE.
BRITISH MEDICAL JOURNAL, August 7th, 1915.

PENETRATING WOUNDS OF THE CHEST AT THE CASUALTY CLEARING STATIONS.

BY
COLONEL SIR WILMOT HERRINGHAM, C.B.,
CONSULTING PHYSICIAN.

THE number of chest wounds admitted to the clearing stations is about 2 per cent. of the whole number of wounds admitted. The most favourable cases are those in which a bullet has gone right through the chest; the least favourable, those made by a piece of shell which is retained within the chest.

In cases where the missile has involved both the chest and the abdomen the prognosis is very unfavourable. Occasionally the whole stomach, or part of the intestine, is drawn up into the pleura through a wound of the diaphragm. In other cases the abdominal viscera are so injured as to prevent recovery. In any case the addition of a wound of these organs to the temporary loss of the use of one lung, which is the usual result of a wound of the chest, produces a condition from which very few recover. Injury to the spinal cord is a still more fatal complication.

The following notes are chiefly drawn from a consecutive series of 211 cases, of which careful observations were made and recorded at the time.

The patients are often much collapsed at time of admission, so that in many cases the heart cannot be felt, and in some cannot even be heard for the first twenty-four hours. With warmth, rest, and morphine, they improve greatly by the second day.

Few cases bleed dangerously from the external wound. When this occurs, it can usually be stopped by plugging the wound. There is often much distress if the external wound admits the free entry and exit of air in respiration. It is almost at once relieved if the wound be made air-tight with strapping over the dressing. For these large openings into the pleura, in which sometimes three or four ribs are smashed, and infection from the open air would be almost inevitable, a form of procedure has recently been adopted which promises well. After careful paring of the wound, removal of loose bone, and blunting of sharp edges, the skin and, where possible, the muscles are drawn together and stitched over the aperture, leaving either only a small hole for a drainage tube or none. If a tube is left in, the cavity is then filled with an antiseptic. One surgeon is using emerald green, 1 part to 1,000 of solution of gum tragacanth, for this purpose.

In all but fourteen of the series there were signs of haemothorax. It is rare for the effusion to increase in extent under observation. The chief safeguard against continued haemorrhage is collapse of the lung. In one case which died from repeated external haemorrhage the lung was found adherent to the pleura throughout. Collapse had not in consequence taken place. In another (not in this series) that died with an increase of the haemothorax, by repeated internal haemorrhage, a piece of metal was found lodged in a large pulmonary vessel which it had partially but not completely severed. The retraction of the vessel was thus prevented.

When the effusion is moderate in size, reaching not above the middle of the scapula, nor further forward than the mid-axillary line, it does not cause serious distress. These cases form the great majority. In them by the third day the pulse falls to 84, the respirations to 28, and the temperature will be falling also. Since the observations of Bradford have shown that fresh haemorrhage hardly ever occurs after the lapse of seventy-two hours from the wound, such cases were, as a rule, evacuated at the end of that time. Information from the base showed that this policy was not attended by any bad results.

When the effusion is greater than this, specially if it is complicated by pneumothorax, the patient usually shows distress. The heart is displaced, the pulse is above 100 and the respiration is over 32. Such cases are not fit to travel. They should be aspirated, and about a pint of blood and as much air as possible should be withdrawn. Some were rendered comfortable by this procedure and were able to travel without damage on the fourth or fifth day. It must be noted that the hospital was close to the train, and that though the journey might last even to thirty hours the conditions were comfortable.

It was not thought desirable at so early a stage to remove the fluid completely with the aid of oxygen replacement; that procedure was therefore left for the base hospitals.

In the latter part of the year 1916 a new method of treatment was adopted in a limited number of cases, especially in patients in whom a missile was found by *x* rays to be retained in the chest. On the second day after the injury, ribs were resected or a costal flap turned back, the pleura opened, and the missile removed. The pleura was then thoroughly washed out, and the whole wound carefully closed. The number of cases so treated is as yet insufficient to enable definite conclusions to be drawn, but experience is so far favourable.

The complications, other than mere size of the haemothorax, which prevented early evacuation, were either septic infection of the effusion on the wounded side, or some disease of the lung on the opposite or unwounded side. In many cases a missile rakes the chest and enters both pleurae. Neither lung can then be called unwounded. The term is confined to cases where one pleura alone has been injured. These complications will now be considered.

In some cases the patient may be comfortable while at rest and have no fever, but on examination there may be the signs of consolidation of the unwounded lung, and movement may produce shortness of breath and some cyanosis. In such cases the condition is that of massive collapse of part, usually at the base, of the unwounded lung. The side is often contracted, the heart is drawn over, and the *x* rays, if available, show the diaphragm raised and motionless. This condition, familiar after abdominal operations in civil life, was found by Bradford to be a frequent complication of chest wounds. It clears up in about a week.

In other cases there may be an increasing cyanosis and distress, even at rest, for which the condition of the wounded side does not account. On the unwounded side there may be the signs of bronchopneumonia. Some of these are true cases of that disease. But more of them are due to engorgement of the unwounded lung which affects the back and the lower lobe chiefly. The whole of the affected part is solid with blood, and on section presents a glistening surface of dark crimson colour. Its

causation is not clear, but the situation argues failure of the pulmonary circulation.

Unquestionably, however, if the cases be followed through, the most common complication of chest wounds is infection of the haemothorax. When cases are sent down on the fourth day not many infected cases are seen at the clearing station. It is, however, important that the medical officer should be quick to mark its symptoms. The face is pale, though there may be a local flush, the expression anxious, the tongue dry, the appetite bad, and there may be vomiting. The pulse and respiration usually quicken and the temperature rises. In many cases gas formation within the thorax is shown by the alteration of the physical signs and the displacement of the heart. But this does not always occur, nor are any of the other symptoms constant.

Briefly speaking, whenever the medical officer is dissatisfied with the progress of the patient and cannot otherwise explain it, he should always suspect septic infection. If suspicion is aroused, aspiration should be performed at once. Sometimes the fluid will be found to stink, or it may be seen to contain pus, or the froth may remain permanently crimson from haemolysis. Any of these signs is sufficient to indicate that a free opening should immediately be made. If doubt remains, it is well, after drawing off a pint of the effusion, to leave the patient for a day, and, unless he has by then obviously improved, to operate. Bacteriological evidence, when forthcoming, is valuable as a confirmation, but it is on the one hand uncertain, for the infection may be confined to a certain part only of the pleura, and on the other, may cause considerable delay. Clinical evidence should always be trusted, and action taken upon it without hesitation.

Five cases of septic infection occurred before the fifth day after the wound in the present series of cases. In all a free opening was made at the clearing station, and all these patients, though some of them were very ill for a time, recovered sufficiently to be evacuated.

In the whole series there were twenty-two deaths, of which two were due to wounds of the heart, ten to conditions of the pleura and lungs, and ten to wounds of the spine or abdomen. The remainder were evacuated.

THE ADMINISTRATION OF ANAESTHETICS AT THE FRONT.

BY

CAPTAIN GEOFFREY MARSHALL, R.A.M.C.(S.R.).

FROM the point of view of the anaesthetist, wounded men may be divided into three main classes:

1. The lightly wounded.
2. Those suffering from serious wounds with more or less shock and haemorrhage, the two factors being commonly associated.
3. Those suffering from a severe degree of sepsis, especially anaërobic infection.

The choice of anaesthetic depends on which of these classes the patient belongs to, as well as on the region of the body injured.

1. THE LIGHTLY WOUNDED.

These patients are good subjects for anaesthesia, so that the chief desiderata are safety, speed, and convenience. The ideal anaesthetic is one with which induction is rapid, and recovery complete a few minutes after operation, so that the patient is in fit condition for early evacuation by ambulance train.

Gas and oxygen anaesthesia meets these requirements best. With its help a greater number of these cases can be dealt with satisfactorily in a limited time than with any other anaesthetic. When this method is not available, ether should be used. The ether is best administered as a warm vapour by "Shipway's apparatus," as both induction and recovery are more rapid than with the open method.

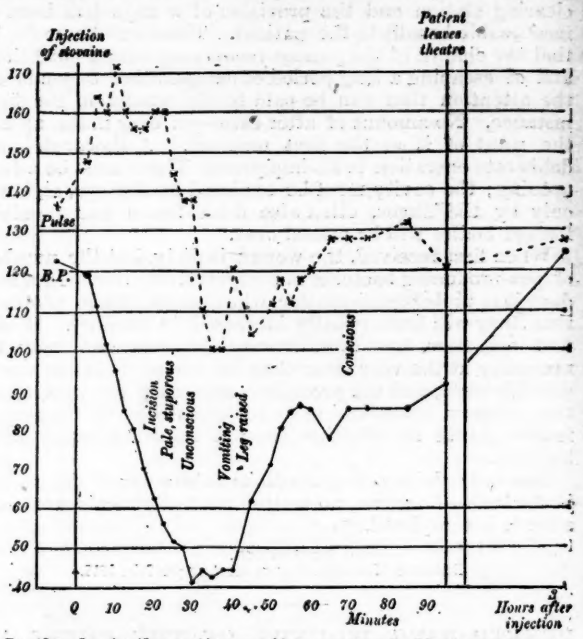
Local anaesthesia can only be employed in a small number of cases, on account of the multiplicity of wounds and their lacerated and soiled condition.

II. THE SERIOUSLY WOUNDED.

In the more serious cases the one consideration is safety. In other words, we require an anaesthetic which will not be harmful to a patient who is still suffering from the shock of injury, and one which will minimize the shock of operation.

Spinal Anaesthesia.

It has been urged that spinal anaesthesia would meet these requirements, especially in wounds of the legs and thighs, and would therefore be of great value in military surgery. In practice, however, it is found that the intrathecal administration of stovaine has dangers of its own when applied to men whose wounds are recent. In a large



In the charts the continuous line represents blood pressure in millimetres of mercury. The dotted line represents pulse rate per minute.

CHART I.—Spinal anaesthesia. Group A. Stovaine 0.075 gram. Wounds of leg and buttock twenty-one hours. Haemoglobin 85 per cent. Operation conservative. Death twenty-four hours later from gas gangrene.

proportion of these cases the administration is followed by a great fall of blood pressure and symptoms of cerebral anaemia, that is, pallor, vomiting, loss of consciousness, and occasionally convulsions. The syncope is sometimes fatal. It is in the man who has lost blood, and whose wounds are less than forty hours old, that spinal anaesthesia is

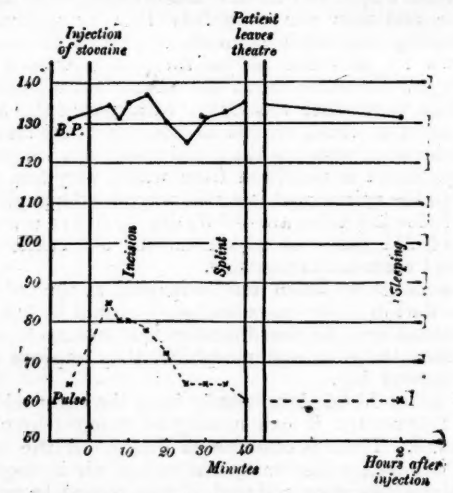


CHART II.—Spinal anaesthesia. Group B. Stovaine 0.1 gram with glucose. Wounds of thigh sixteen hours. Haemoglobin 102 per cent. Operation conservative. Recovered.

dangerous. This is shown by an analysis of fifty consecutive cases operated on at a clearing station under stovaine spinal anaesthesia.

All the patients had wounds of the lower extremities. In each case the percentage of haemoglobin in the patient's blood was estimated before operation; a low percentage of haemoglobin in a man whose wounds are recent may be taken to indicate that the patient has bled. The fifty cases fall into three groups:

Group A.—Men operated on within forty hours of receiving their wounds, and whose blood was dilute (indicating haemorrhage).

Group B.—Men operated on within forty hours of receiving their wounds, whose blood was *not* dilute.

Group C.—All cases in which a greater interval than forty hours had elapsed between wounding and operation.

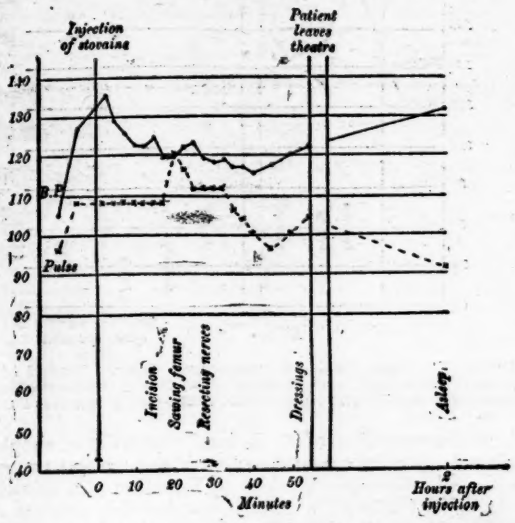


CHART III.—Spinal anaesthesia. Group C. Stovaine 0.1 gram with glucose. Wound of thigh and femoral artery twenty-three days. Haemoglobin 45 per cent. Gangrene of leg. Amputation lower third thigh. Recovered.

In Group A there were twenty-two cases. Of these, nineteen showed symptoms of collapse after injection of the anaesthetic. The average fall of blood pressure was 57 mm. of mercury; in only three cases was the fall of pressure less than 35 mm., the greatest fall was 99 mm.

In Group B there were sixteen cases. Of these, only three developed any untoward symptoms after injection, and these were trivial—in one case nausea and in the other two pallor only. The average fall of blood pressure was 17 mm., the greatest 33 mm.

In Group C there were six cases. None showed any symptoms of collapse. The average fall of blood pressure was 19.7 mm. and the greatest 35 mm.

For the prevention or combating of the collapse the most important factor was found to be the position of the patient; the symptoms are alleviated by raising the legs and lowering the head. It is safe to lower the head fifteen minutes after injection. Neither strychnine nor pituitrin were of any use in combating the collapse, nor did preliminary injection of strychnine prevent it. The dose of stovaine given varied from 0.05 to 0.1 gram, and within these limits the fall of blood pressure was not proportional to the dose of the drug. Some of the greatest falls of pressure were associated with the smallest doses of stovaine and vice versa. With doses smaller than 0.05 gram, the anaesthetic effects were so slow and uncertain as to make the method impracticable at a clearing station.

Wounds of the Limbs Necessitating Amputation.

There are few more unfavourable subjects for anaesthesia than the man who is suffering from the shock of a recently shattered limb, and who has to undergo the further shock of amputation. The mortality of these cases can be greatly reduced if correct procedure be followed.

In the first place, the patient must be put to bed and surrounded with hot bottles or a hot-air bath. However urgent operation may be surgically, it is useless to perform it before the patient has been thoroughly warmed up.

In the second place, morphine should be withheld before operation or given only in small doses.

In the third place, gas and oxygen should be the anaesthetic used for operation. Results are so much better with this mixture that no other anaesthetic is justifiable.

If chloroform be used, the patient's condition will deteriorate during the administration, and he will not rally afterwards. With inhalation ether the condition may improve and the blood pressure rise during operation, but there will be a collapse during the next two hours. With intravenous ether the temporary improvement is more striking and the after-collapse more profound and more often fatal.

Shock.

Shock is a condition which still evades precise definition, although seen so commonly in wounded men. The injuries which cause it are almost invariably severe in themselves, that is, they involve important structures or extensive areas of tissue. In a typical case there is dusky pallor of the face, the radial pulse is flickering or imperceptible, and the surface temperature low. There is repeated vomiting, but the patient shows remarkably little mental disturbance, and may be fully conscious and intelligent within a few minutes of death. The arterial blood pressure is often higher than might be expected from the character of the pulse, and shock is usually profound if associated with a systolic pressure lower than 80 mm. of mercury; we refer to readings taken by means of a Riva-Rocci sphygmomanometer with auscultation over the brachial artery. The blood in the capillaries of the extremities is dark and cyanotic. In cases of shock unassociated with haemorrhage we have found the blood to be more concentrated than normal.

Treatment of Shock before Operation.

We have stated that, however urgent it may be, operation should not be performed on a patient suffering from shock until means have been taken to mitigate this condition.

The one measure which commonly produces definite improvement is the application of external warmth. Excellent results have been obtained by the application of heat from electric light lamps or by the use of an improvised hot-air bath, and if such a patient as we have described be put to bed and treated by these methods, or surrounded with hot bottles, his surface temperature rises, his colour improves, and his arterial blood pressure will as a rule go up steadily for several hours. He will then be much less likely to succumb if subjected to a severe operation.

Fluids are best given either by mouth or rectum. Subcutaneous infusion produces no measurable effect in this type of case; and if death occurs as late as thirty hours after infusion, the bulk of the fluid will still be found in the subcutaneous tissues. The intravenous administration of saline is of little use before operation. It causes a temporary rise of blood pressure and slowing of the pulse rate, but does not render the patient less susceptible to further shock. The blood pressure falls again as soon as operation is begun. Transfusion is best done towards the end of operation; it will then often cause a lasting improvement in the patient's condition. We have found that hypertonic saline produces a more lasting elevation of blood pressure, slowing of the pulse, and dilution of the blood than does the normal solution. Transfusion with blood gives still better results. The use of artificial viscous fluids is still under trial.

The Limitation of Shock during Operation.

The recently injured patient is particularly susceptible to further shock, and this susceptibility is increased by certain drugs used in the production of anaesthesia, for example, chloroform, ether, and morphine in large doses. These drugs should therefore be avoided in dealing with a patient who is suffering from recent wounds and who has to undergo a severe operation such as amputation through the thigh. Chart IV shows the serious fall of blood pressure which occurred an hour after amputation under ether vapour anaesthesia. Charts V and VI illustrate the

still greater collapse after intravenous ether. Chart VII shows how trivial is the effect on pulse rate and blood pressure when the operation is done under gas and oxygen.

We have already indicated that amputation is a much

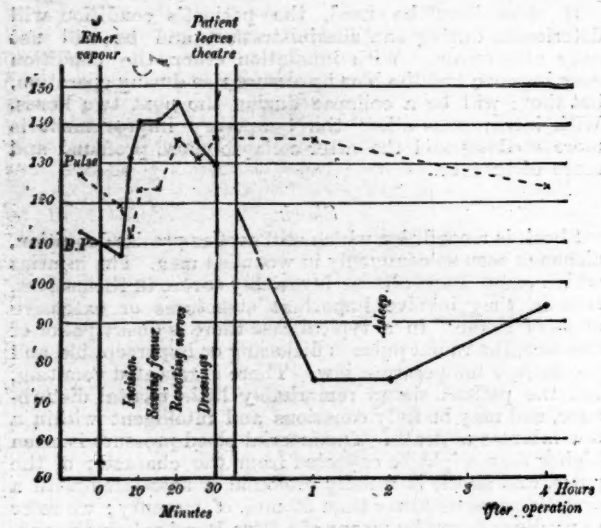


CHART IV.—Anaesthesia by ether vapour. Wound of leg thirty-six hours; tibia shattered. Haemoglobin 62 per cent. Amputation lower third thigh. Recovered.

less dangerous procedure to a patient who is not already suffering from shock or haemorrhage. Chart III was an example of amputation under spinal anaesthesia, and Chart VIII under intravenous ether, both in cases of severe sepsis but in which the initial shock of injury had passed off. Chloroform is dangerous even in this type of case; Chart IX illustrates a fatal example.

Wounds of the Head.

Operations on the head may be performed under local anaesthesia. All tissues of the scalp are infiltrated in a circle surrounding the site of operation with a solution of

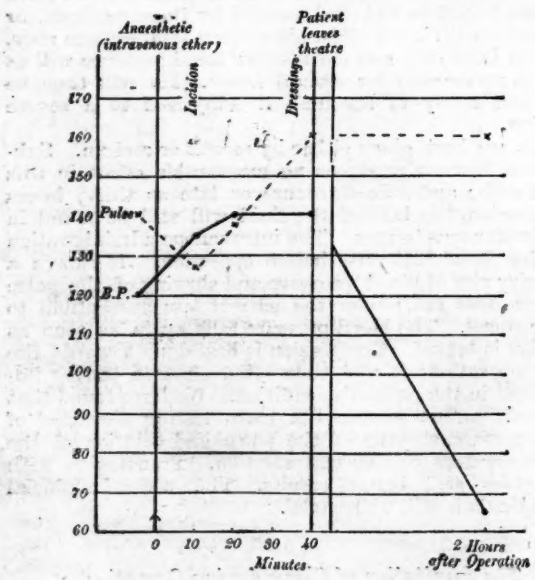


CHART V.—Anaesthesia by intravenous ether. Wound of thigh twenty-two hours; femur fractured. Haemoglobin 84 per cent. Operation conservative. Recovered.

novocain and adrenalin. No pain is felt even when bone and dura are dealt with. On the other hand, the forcible cutting of bone is disturbing to the patient, so that where mentality is unimpaired, hyoscine and morphine should be given an hour before operation. If general anaesthesia is preferred, this may be obtained safely and conveniently with Shipway's apparatus. A warmed mixture of ether and oxygen is administered through a catheter passed down the more patent of the two nostrils.

Wounds of the Chest.

Ether should not be administered to a patient with a perforating wound of the chest, as it usually provokes fresh intrathoracic haemorrhage. For small operations,

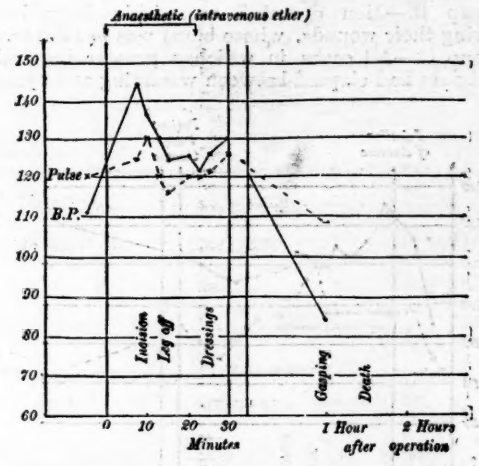


CHART VI.—Anaesthesia by intravenous ether. Wound of leg six days. Secondary haemorrhage seven hours before operation. Amputation mid-thigh; collapse and death eighty minutes after.

such as the resection of a rib, local anaesthesia should be employed. The intercostal nerves of the rib to be resected and the rib above are blocked by injection of a solution of novocain and adrenalin into the subcostal grooves close to the angles of the ribs. For more extensive operations, requiring general anaesthesia, we give a preliminary injection of morphine gr. $\frac{1}{6}$, hyoscine gr. $\frac{1}{100}$, and atropine gr. $\frac{1}{100}$, and follow this with a minimal amount of warm chloroform vapour with oxygen.

Wounds of the Abdomen.

For these cases we have found the most satisfactory anaesthetic to be a warmed mixture of ether vapour and oxygen. Compared with "open ether," we find that the warm vapour gives a more rapid and quiet induction, easier breathing, and diminished heat loss during operation and less vomiting afterwards.

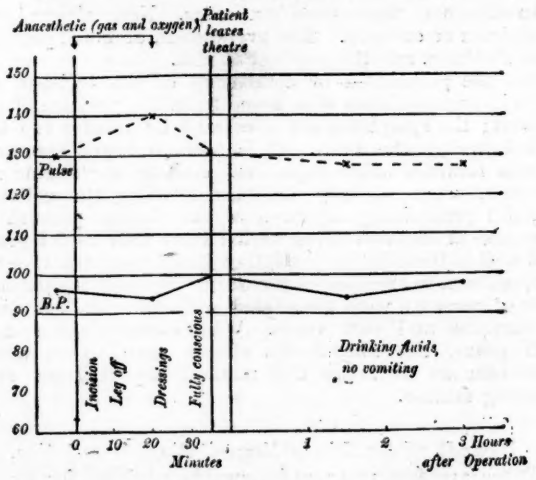


CHART VII.—Anaesthesia by gas and oxygen. Wound of thigh twenty-one hours; femur shattered. Patient pale and vomiting. Haemoglobin 82 per cent. Amputation mid-thigh. Recovered.

Men wounded in the abdomen are especially liable to develop bronchitis, perhaps owing to deficient movement of the lower part of the chest. In a series of these cases anaesthetized with open ether, 54 per cent. developed bronchitis after operation. In a comparable series anaesthetized with warm ether vapour, the percentage of bronchitis was only 14.7.

Blood Pressure during Operations on the Wounded Abdomen.

During the course of an ether vapour anaesthetic the blood pressure shows a tendency to rise, but if there is much manipulation of gut and mesentery, it will gradually fall. The process may be continued for hours without the pressure falling to a dangerous level. Exposure of gut

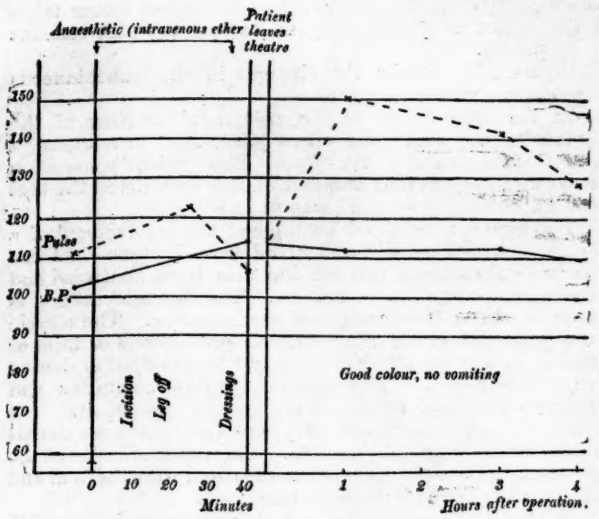


CHART VIII.—Anaesthesia by intravenous ether. Wounds of both thighs fifteen days. Left thigh amputated thirteen days. Severe sepsis, persistent hiccough and vomiting. Amputation lower third right thigh. Recovered.

outside the abdominal cavity produces a much more serious effect. If more than two or three feet are exposed, the blood pressure will commence to fall after a few minutes, and will continue to fall rapidly until the gut is replaced. This effect is seen when stomach and omentum are exposed, and even with great omentum alone. The indication is that surgeons should make big incisions, and work as far as possible with the gut lying inside the abdomen. Covering the exposed gut with pads wrung out in hot saline does not prevent the fall of blood pressure.

Exposure of gut produces far less effect if the patient is not under an anaesthetic. We have seen men arrive from

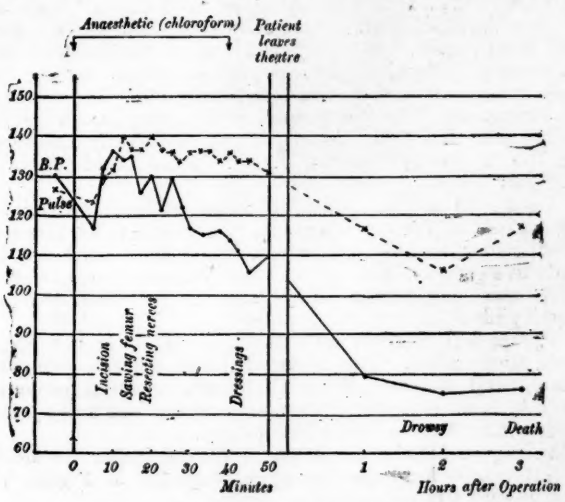


CHART IX.—Anaesthesia by chloroform vapour. Wound of leg seven days. Secondary amputation lower third thigh. Death ten hours after operation.

the line with several feet of intestine prolapsed through a wound, yet their blood pressure was within normal limits. In one case more than two-thirds of the small gut had been outside the abdominal cavity for at least four hours, and this man's blood pressure was 142 mm. of mercury, and his pulse rate only 108. The patient recovered.

Apart from copious haemorrhage, there is one other procedure which causes rapid fall of blood pressure in abdominal operations. This is turning the patient on his side. The effect is only seen if the patient has been under the anaesthetic for a considerable time before being turned. At the end of an abdominal operation the patient may be in good condition. He is then turned on the right or left side so that the surgeon may excise a wound in the back. In a few minutes there is a great fall of blood pressure, and the radial pulse disappears. It may be hours before the patient recovers this lost ground. If possible, wounds of the back should be dealt with before laparotomy, as turning the patient has no ill effect during the first half-hour of an ether anaesthesia.

If chloroform be used in these abdominal operations, the blood pressure will fall during administration and for some hours afterwards. This drug is therefore to be avoided except where ether is contraindicated, as in cases in which projectiles have penetrated the chest as well as the abdomen.

The intrathecal administration of stovaine is unsafe, and should not be employed.

III. PATIENTS WITH SEPSIS.

The patient whose condition is rendered grave by sepsis will stand an amputation far better than the man who is suffering from shock. In the septic case, gas and oxygen again gives excellent results, but spinal anaesthesia, warm ether vapour, and intravenous ether are also comparatively safe. Chloroform, however, is to be avoided, as it is often followed by a slow fall of blood pressure which ends in death during the twelve hours succeeding operation.

THE COLOUR CHANGES SEEN IN SKIN AND MUSCLE IN GAS GANGRENE.

[WITH COLOURED PLATES.]

BY

COLONEL CUTHBERT WALLACE, C.M.G., A.M.S.,

CONSULTING SURGEON, BRITISH ARMIES IN FRANCE.

A SHORT time ago[1] I ventured to support Kenneth Taylor's statement that gas gangrene was primarily and mainly a disease of muscle. Further work and observation have only strengthened this belief. It is the object of this paper to describe the naked-eye alterations in the appearances of the skin and muscle in the sequence in which they occur.

Through the kindness of the Medical Research Committee I am able to illustrate some of the changes by the reproduction of coloured drawings made by Sergeant A. K. Maxwell, R.A.M.C. I should like to take the opportunity of congratulating him on the skill he has displayed in catching the delicate tints in the colour changes.

Colour Changes in the Skin.

The changes in the skin of an affected limb may share in the general icteric tint that affects the whole body in some cases. This has been well portrayed elsewhere,[2] and need not detain us here. Coming to the more local lesions, it is first necessary to state that the skin of an affected limb may appear, and usually is, perfectly normal in the early stages; even under a normal skin, however, the disease in the muscles may be so far advanced as to necessitate amputation. The first essential change in the colour of the skin is due simply to the swelling of the limb. At this stage the skin looks somewhat tense, just as it does over any deep-seated swelling, and is paler than normal, owing to the blood being driven out of it by pressure. Resonance to percussion, and even crepitations, may be perceptible at this stage. Simple pallor of the skin is succeeded by a dirty cream tint, which may be taken to indicate that gangrene is certainly established. Up to this stage examination through an incision may reveal only partial or complete involvement of a single muscle, or of a limited group of muscles, so that the condition may be suitable for treatment by local excision.

The subsequent changes in the skin are quicker and more dramatic. Areas of purple staining appear, which enlarge and coalesce. The margins of these are fairly distinct but irregular, and the intervening skin is greyish-white in colour. Soon there appear blebs filled with fluid

which is stained by altered blood; removal of the cuticle from these exposes a shiny purple-red area of dermis. When this condition of the skin is reached it may safely be inferred that the gangrenous process is so far advanced as to necessitate amputation.

In the last stage to which reference need be made, the purple is succeeded by a dark yellow-green tint. It will be seen that these later changes are identical with what may occur in any limb after death, and are essentially *post-mortem* phenomena due to bacterial action. The late colour changes may be influenced according to the relative parts played by bacterial action on the one hand and by arrest of blood supply on the other. Thus, near an infected wound the yellow-green tint may develop early, whereas in a segment of limb infected only after its blood supply has been cut off, the stage of purple discoloration may still predominate at operation.

Figure I is a drawing made from a forearm which was amputated on account of gas gangrene. The projectile passed across the flexor aspect of the forearm, causing great laceration of the muscles. The whole of the muscles on the flexor aspect were gangrenous, the change being most advanced in the deep flexors and the supinator brevis, which were diffluent. There was in this case ample opportunity for direct infection of the different muscles. The main arteries were intact, so that the gangrenous process was entirely due to infection; in other words, it was not a case of infection after arterial death, but of infection producing total destruction of the muscles and consequently of the skin and subcutaneous tissues. The drawing speaks for itself and requires but little explanation. It shows the purple mottling of the skin, and the contrast between the infected flexor muscles seen through the wound and the normal-coloured muscle by the side of the cut humerus.

There is another change in the skin—namely, "bronzing," to which allusion must be made because it has attracted considerable notice. It is regretted that no example of this could be obtained while the artist was present, but a coloured drawing of the condition has been published elsewhere.[3] The plate was merely described as "multiple shell wounds," but the bronzed area can be well seen over the hollow part of the man's back. This colour change is not common, in my experience, on the limbs, but is seen more often on the body, especially in connexion with wounds of the extraperitoneal part of the colon. Sometimes it is accompanied by crepitations of the subcutaneous tissue, but is often found without this manifestation. The tissue beneath is sometimes normal, or only slightly oedematous, sometimes distinctly oedematous, sometimes yellow-green in colour. At one time this discoloration is the herald of a violent infection which cannot be controlled by incisions, at another time it will disappear without treatment. The causal agent is, so far as I am aware, unknown.

Colour Changes in the Muscles.

Figure II represents a dissection of the thigh of a man who died from multiple injuries and gas gangrene of the thigh. A wound is present over the vastus externus, part of which has been carried away. The resulting dirty cavity can be seen, as can also the infected subcutaneous tissue, which is of a dirty yellowish-green hue. The vastus externus, although wounded, did not become gas-gangrenous; this may be attributed, perhaps, to the open nature of the wound. The missile passed behind the rectus tendon, and was found lodged against the fibres of the vastus internus. The point of interest lies in the condition of the latter muscle, which was gas-gangrenous throughout. The change in the colour of the muscle is a subtle one, but can be easily seen. Although not so apparent in the reproduction, the same change was present in the outer edge of the lower part of the sartorius, just where it lay in apposition to the vastus externus. The colour of the vastus externus is altered from the normal red-purple to a brick-red. The whole muscle was dead and non-contractile, and some bubbles of gas were visible between the fasciculi. It is to this stage that I have given the name "red death." The other muscles of the thigh were not affected. Death occurred in this case fifty-six hours after the wound was received, and the condition of the thigh was found at the *post-mortem* examination.

The intermuscular connective tissue showed but little alteration in this specimen. This is often the case, but at other times there are distinct alterations. Gas may be found abundantly along the great vessels, and also commonly in the subcutaneous tissues. It is important to note that cultures from such gaseous tissues may prove sterile. At other times the connective tissue is oedematous without being discoloured, and occasionally the appearance is distinctly gelatinous. Later, the oedematous tissue takes on a yellow or yellowish-green colour, but still remains transparent.

Figure III exhibits the changes in the subcutaneous tissues in a striking degree.

In this case there was a compound fracture of the humerus just above the elbow-joint, and, in addition, a penetrating wound of the chest. The patient's condition was so precarious that amputation was considered the best course, especially as there was no radial pulse.

The case is a beautiful example of the involvement of a single wounded muscle, and would have been an ideal one for a local excision had not the arm been shattered and the man's condition dangerous. The supinator longus is seen in the diffluent stage of gas gangrene. The muscle was yellowish-green in colour, and quite devoid of form or tone. It was so soft that it could be moulded or dented with the finger. The greenish-yellow coloration and oedematous state of the subcutaneous tissue are well seen, although before the skin was reflected the external appearances were not marked. The other muscles of the forearm, as can be seen in the drawing, were normal and still readily contractile when examined.

In the small segments of muscle shown in Figures IV, V, VI, and VII it is possible to trace the colour changes in greater detail. All the pieces shown were taken from the gluteus maximus muscle, except one (Fig. VII), which is a portion of a tibialis anticus muscle.

Figure IV is drawn to represent the normal colour of gluteus maximus muscle, the actual specimen being taken soon after death from a patient who died of acute peritonitis. The normal colour, sharpness of outline, and general appearance of the fasciculi, show that the muscle was healthy.

Figure V shows a piece of muscle which was dead, non-contractile, crepitant to the touch, and brick-red in colour. The bubbles of gas, or rather the spaces once occupied by them, are distinctly seen. In this stage the muscle is very friable, and the gas can, by gentle stroking, be pushed about from place to place between the fibres.

Between the normal contractile muscle, as represented in Figure IV, and the condition of "red death" seen in Figure V, there occurs a zone of demarcation which it has not been possible to portray. Here, at the limit of the advancing gangrene, the muscle is simply lighter in colour than normal, but not definitely red. It is firmer in consistence than the normal, and no crepitation can be made out. This advancing edge is more fully discussed in the paper by Captain J. W. McNee and Captain J. Shaw Dunn.

Figure VI shows a piece of muscle from the tibialis anticus at a further stage in the gangrenous process. The colour is now passing gradually from brick-red to an olive-green. The tissue has become more friable, and the consistence may almost be described as "putty-like."

Figure VII exhibits an end-stage, which is not often seen at operation. The colour of the muscle is a greenish-black, and the surface is glistening. Such a piece of muscle is so soft that it tends to flatten out and spread over the surface on which it is placed.

In Figure III the condition of the supinator longus is intermediate between the stages depicted in Figure VI and Figure VII respectively.

I must thank Captain J. W. McNee and Captain J. Shaw Dunn for the care and trouble they have taken to prepare the specimens from which the drawings were made.

Lieutenant-Colonel Frankau and Captains Neligan and Drummond in their paper demonstrate the clinical use that can be made of the pathological fact—namely, the involvement of single muscles in early cases of gas gangrene.

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[1] BRITISH MEDICAL JOURNAL, September 16th, 1916. [2] *British Journal of Surgery*, vol. iii, No. 9. [3] Ibid., vol. iv, No. 13, p. 57.

FIG. 1

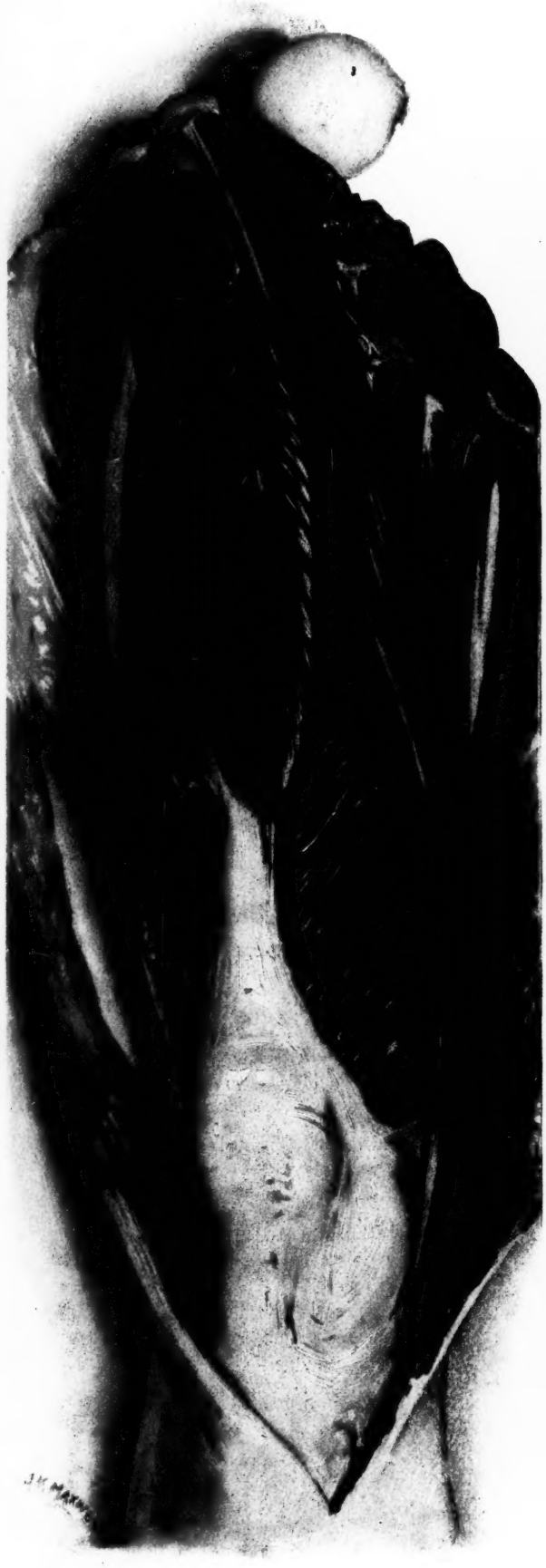

FIG. II.

FIG. III.

FIG. IV.

FIG. V.

FIG. VI.

FIG. VII.

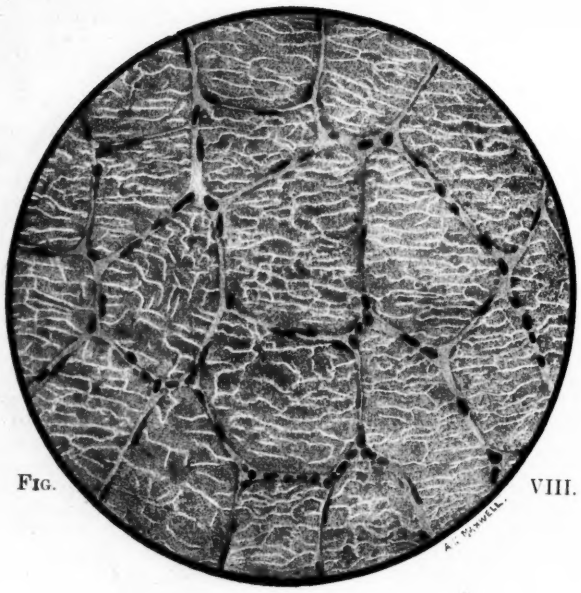

FIG. VIII.

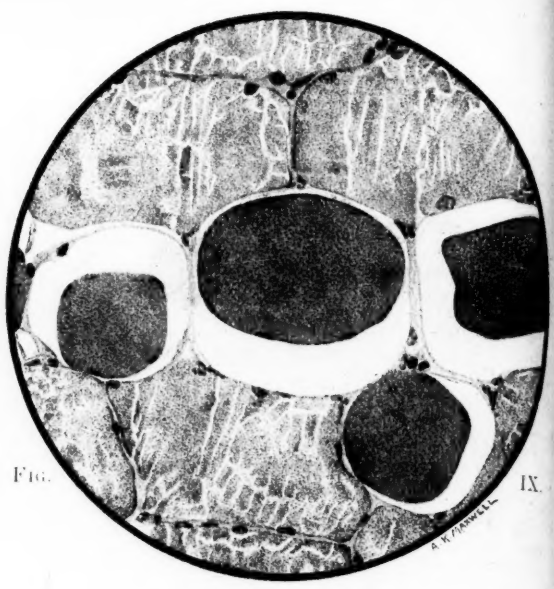

FIG. IX.

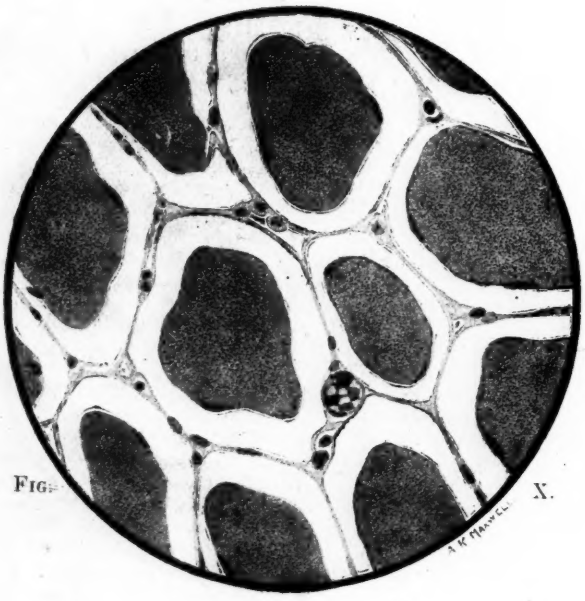

FIG. X.

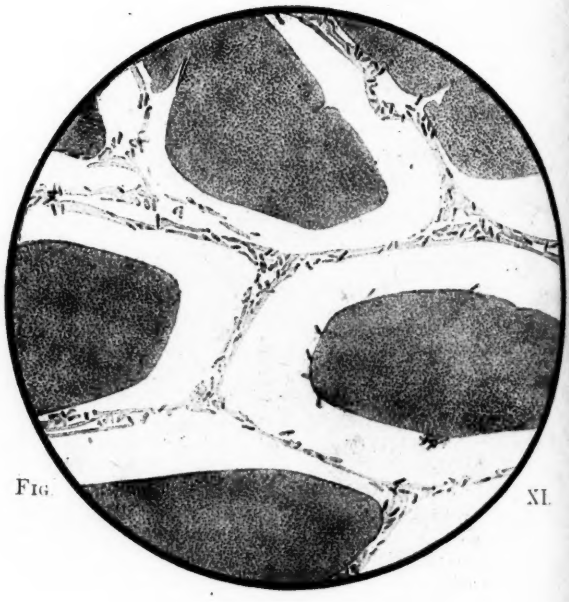

FIG. XI.

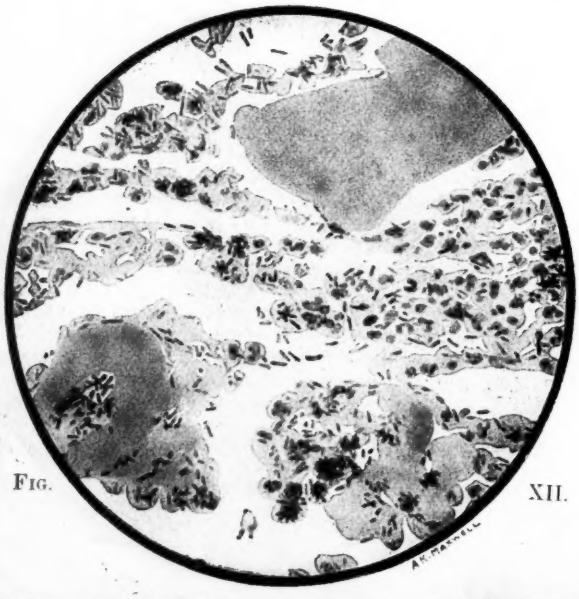

FIG. XII.

FIG. XIII.

THE METHOD OF SPREAD OF GAS GANGRENE INTO LIVING MUSCLE.

[WITH COLOURED PLATE.]

BY

CAPTAIN J. W. McNEE, M.D., R.A.M.C.,

AND

CAPTAIN J. SHAW DUNN, M.A., M.D., R.A.M.C.

(A Report to the Medical Research Committee from a Mobile Laboratory in France.)

THIS contribution to the pathology of gas gangrene deals primarily with the method of spread of the acute disease into living muscle.

In our experience gas gangrene is essentially a muscle disease, and we have never seen it commence where injury of muscle could be excluded. The somewhat rare cases of "metastatic" gas gangrene, such as those described by Mullally and McNee,[1] Kenneth Taylor,[2] etc., come into the same category, the primary focus in every instance being in damaged muscular tissue. No example of gas gangrene beginning in, and remaining localized to, the subcutaneous tissue has been met with, and a condition spreading below the skin which is met with in base hospitals would appear to merit some special investigation before a relationship to the general type of gas gangrene can be established.

Clinically, the rapidity of spread of gas gangrene into living muscle, once the disease has begun, is so remarkable as to demand some definite explanation such as has been sought for by histological methods and is suggested here.

The varieties of the acute disease investigated in this way are sufficiently indicated in the articles published by Cuthbert Wallace, and by Frankau, Drummond, and Neligan. Part of our histological material, indeed, was obtained from the actual cases described by these writers.

The disease may commence in a wounded limb within an extraordinarily short time after the injury. The earliest case of gas gangrene examined histologically showed the condition already established three and a half hours after the wound was received, and we have seen massive gas gangrene of a limb lead to a fatal issue twelve hours after a wound of the thigh.

A point worth notice is that death may occur quickly, following a comparatively slight wound, when examination *post mortem* shows gas gangrene involving only a small bulk of actual muscle tissue. The material elaborated by the bacilli, therefore, whether it be a true toxin or not, is at any rate a powerful systemic poison. Sir Anthony Bowlby has pointed out to us that cases of this kind may very readily be mistaken for death from shock alone.

Wounds involving main blood vessels—for example, the popliteal artery—are notorious for the frequency with which gas gangrene develops in the distal segment of the limb, and it is necessary to point out here that there are differences between the spread of gas gangrene following such an injury and the invasion of living muscle. Where the main artery is cut, massive or "group" gangrene generally occurs, whole groups of muscles being involved from end to end simultaneously by the growth of organisms throughout the muscles from which the blood supply has been cut off.

The spread of gas gangrene into living and healthy muscle, with an intact blood supply, is a different and less easy problem, with the solution of which this paper is mainly concerned. With regard to this, two facts must here be briefly brought to mind. One of these is the clinical observation, now well established and borne out by the microscope, that gas gangrene tends to spread in the longitudinal axis of muscles, so that single muscles are involved from end to end while neighbouring ones are untouched. It must also be remembered that individual muscle fibres stretch without interruption from one tendinous attachment to the other.

It is essential, in investigating the spread into muscle, to work on material which is absolutely fresh. Most of the examinations have been made on limbs amputated for gas gangrene, and brought at once to the laboratory while the healthy muscles were still contractile. Other tissues examined were either from single muscles removed by operation or from *post-mortem* examinations carried out within an hour or two at most after death. Unless fresh material is used, quite fallacious conclusions may be drawn, since, especially in summer time, the organisms proliferate and produce gas with extreme rapidity in the warm body after death.

In amputated limbs, and in the stumps left at operations, we have had ample opportunity of proving that the anaërobic organisms are present in the healthy muscle at a considerable distance from the actual seat of the gangrene. Thus the presence of the organisms in the muscles, even though abundant, does not constitute gas gangrene, and, indeed, such infected muscles may never become gangrenous. This is well seen in amputation stumps, known to be infected, but in which no recrudescence of the gangrene occurs after the operation, in a majority of cases.

DESCRIPTION OF COLOURED PLATE.

Figures VIII, IX, and X represent the conditions found at different levels in a single block of tissue from the advancing margin of gas gangrene. Between Figure VIII and Figure IX there is an interval of 2.5 mm. of length, and the same distance between Figures IX and X.

Fig. VIII.—Normal muscle in transverse section, just beyond the edge of the spreading gangrene. (Haemalum and eosin.)

Fig. IX.—Muscle from as nearly as possible the visible advancing edge. Note the marked contrast between the dead coagulated fibres, which are separated off from their sheaths, and the paler normal fibres. (Haemalum and eosin.)

Fig. X.—All the fibres are here degenerated, but their sarcolemmal nuclei still appear intact. Separation of the fibres from their sheaths is everywhere complete. (Haemalum and eosin.)

Fig. XI.—This shows the distribution of organisms at a comparatively early stage. There are large numbers of bacilli in the reticulum, but they have not yet invaded the fibres. This stage is slightly more advanced than that depicted in Fig. X, and the nuclei of the sarcolemma have disappeared. (Leishman's stain.)

Fig. XII.—Phagocytosis of anaërobic bacilli in a zone where the process of gas gangrene has been arrested. The leucocytic reaction is in remarkable contrast with the previous figures. (Leishman's stain.)

Fig. XIII.—A late stage of gas gangrene, showing complete disintegration of muscular fibres and reticulum. In this material organisms were present in large numbers, and frequently in the substance of the fibres. (Haemalum and eosin.)

BACTERIOLOGY.

The bacteriology of the acute disease will be referred to only briefly, as so much has already been published on the varieties of anaërobic bacilli to be found. It is enough to say that all our work has been done on acute and often fulminating cases, such as are seen in casualty clearing stations on the front. In these cases mixed anaërobic infections are the rule, but sufficient work has been done in isolating the different organisms to incriminate the *Bacillus aërogenes capsulatus* (*B. perfringens*) as the commonest and most abundant organism present. It appears often to be the only organism which is isolated from the spreading margin of the gangrene at a distance from the wound. The biology of this organism, with its powerful fermentative action on sugars and resulting evolution of gas, fits in very well with the extraordinary rapidity of spread of acute gas gangrene.

A number of experiments to reproduce a spreading gas gangrene have been carried out in animals to amplify and confirm the findings in human tissues. These will be referred to again later on.

HISTOLOGICAL CHANGES.

The material examined histologically was almost always embedded in paraffin, after fixation in 10 per cent. formalin, or in corrosive sublimate; frozen sections and tissue fixed by boiling were also used for the investigation of certain important points. Muscle taken for examination must be handled with great care or fallacies from artificial separation of the fibres may arise. The histology of single muscles, removed at operation and necessarily pulled on in the act, required, therefore, careful consideration before conclusions could be drawn from the sections. The best material was obtained from amputated limbs, in which the individual muscles could be carefully dissected, and pieces cut out with a sharp knife or razor, all pulling being avoided.

In a few cases only we have had the good fortune to

obtain a muscle with fairly long fibres, in which the advancing edge of a spreading gas gangrene could be clearly recognized. It is from these fortunate instances, however, by the examination of serial sections, that most of the information has been obtained of the method of spread. Macroscopically the appearance of this spreading margin is interesting. It is sometimes fairly sharp, but in other instances is irregular, from the process having spread further along some fibres than others. The muscle fibres at the margin are paler and duller than the normal, but the colour change is little more than might be accounted for by total absence of blood in the part involved. The outer limit of the process, while indefinite, can be mapped out fairly closely if the healthy muscle beyond is still contractile (in tissues examined very soon after amputation), as contractility is lost in the part becoming gangrenous. At the advancing edge also the muscle tissue is very much firmer to touch than the healthy fibres beyond, and this firmness passes back into the obviously gangrenous muscle behind.

When the whole of the advancing edge is cut out, along with a margin of tissue on either side of it, and examined in serial transverse sections, the appearances presented are very striking, and are shown in the first three microscopic drawings (Figs. VIII, IX, and X).

Figure VIII represents the muscle in transverse section just beyond the furthest limit of the advancing gangrene; the muscle here was still healthy and contractile. The muscle fibres appear normal, and are seen to be made up of fibrils which show as dots in the transverse section. The cracks in the fibres are artefacts produced in the cutting of the paraffin sections. They occur so constantly in transverse sections of normal fibres that they can almost be taken as characteristic of healthy muscle. The flattened nuclei of the sarcolemma are well seen, and also the interstitial tissue between the fibres, which carries the blood vessels, lymphatics, etc.

Figure IX is from a section taken from as nearly as possible the advancing edge, as seen by the naked eye. The muscle here had lost its contractility. Various normal fibres are seen, with characters as above, while others exhibit a very striking change. The staining reaction is different, being an almost uniform eosin tint, while the dots indicating the individual fibrils are lost. These fibres are not shrunken, but on measurement are often found to be somewhat swollen. In spite of this, however, these fibres are well separated off from the interstitial connective tissue, to leave what appears in the section as a clear space. Occasionally the separation of reticulum from fibre is partial, and confined to a sector only; but even in such instances the fibre still shows the uniform eosin tint indicative of degeneration. The sarcolemmal nuclei of the separated fibres still stain brightly. The contents of the spaces between the altered fibres and the interstitial meshwork will be discussed later, and it may simply be noted here that such fibres are obviously cut off from their blood supply in the interstitial tissue.

Figure X is from a section taken from the tissue 2½ mm. behind the one just mentioned, and in it all the fibres have undergone the degenerative change described above. The fibres are all separated off completely from the interstitial tissue, which forms a regular network between them. The regularity of the network is in no way exaggerated in the drawing, and no difference would be observed in a colour photograph of many of our sections. The nuclei of the sarcolemma are at this stage stained as in the normal fibres.

In longitudinal sections of tissue taken to include the advancing edge, the process is less striking to the eye, as it is impossible to get complete lengths of fibres in any one longitudinal section. The appearances are quite easy to follow, however, having in mind the information obtained from the transverse sections. A fibre which stains normally can often be traced to a point where, quite suddenly and with a very definite edge, the colour change to the strong uniform eosin tint is met with, and the normal striation disappears. Practically coinciding with the colour change, which no doubt represents the margin of death of the fibre, the interstitial tissue is seen to separate off and leave the clear space which is so obvious and striking in the transverse sections.

The significance of these observations may now be briefly dealt with.

In transverse sections stained for organisms these are found far beyond the edge of the gangrene in the interstitial tissue between the healthy fibres. What, then, determines the advancing death of the individual fibres? The whole question seems to us to be bound up in the contents of the spaces left between the degenerated fibres and the meshwork of interstitial tissue. The altered fibres are not shrunken, and the muscle at the spreading margin is tumid and increased in bulk. This swelling is evidently due to the extra room taken up by the spaces described. It was a tempting view to take, that these spaces might be filled by gas alone, which, by the mechanical effect of pressure and by cutting off the fibres from their blood supply in the interstitial tissue, might lead to their speedy death. Attempts were made to prove this view correct by cutting thick frozen sections of fresh unfixed tissues, and looking for evidence of gas under the microscope, but none could be detected. On the other hand, in tissues fixed in corrosive sublimate, and more especially in material fixed by boiling before being embedded in paraffin, evidences of amorphous deposit in the spaces were found, which seemed to point to the contents being a fluid. In tissues fixed in formalin, from which the drawings were made, the spaces almost invariably appeared quite empty, and free from anything which stained. We therefore are of opinion that a toxic fluid, perhaps similar in constitution to the oedema which always accompanies gas gangrene to a greater or less extent, spreads along between the interstitial tissue and the fibres, killing off the latter as it advances. Once the fibres are killed, the anaërobic bacilli live on them practically as saprophytes, breaking down the sugars and producing abundant gas. This process is in strong contrast to what occurs in healthy muscle, where the presence of the organisms is without effect on the living fibres.

The rapid spread of the disease into living muscle can, we think, be explained on these lines. Fibres, each of which stretch without interruption for a considerable distance, are killed in the manner which has been described, and the dead tissue is then rapidly broken down and gas formed. The circle is a vicious one, for the toxic fluid which spreads between the fibres is no doubt formed in the gangrenous tissue behind, and so the condition spreads until the ends of the fibres are reached. This view also gives a satisfactory explanation of how single muscles may be found gangrenous, no spread having occurred to others close at hand. No opinion can yet be given as to the nature of the toxic fluid, which may either be a true bacterial toxin or something dependent on the breaking down of tissues.

Other points brought out by histological examination may now be referred to. With regard to the route followed by the organisms, these are, at the spreading edge, never found in the muscle fibres themselves, but are practically confined to the reticulum (Fig. XI). When the fibres are dead and being broken down, the bacilli invade the disintegrating fibres in numbers. At a later stage (Fig. XIII) all definite muscular structure becomes lost and gas is present abundantly between the remnants of the fibres. It is interesting to note that in muscle at this advanced stage of the disease the number of organisms appears much less than in the spreading zone. This is evidently partly due to many organisms staining badly, so that ghost forms are numerous. It seems probable that this stage, once reached, is inimical to the life of the bacilli, so that many are destroyed and disappear.

In rapidly spreading gas gangrene leucocytes are generally conspicuous by their absence in the muscular tissue involved (although they may be present in some number in the interfascicular planes). The mere speed of progression of the process in muscle may probably account for this, as a leucocytic reaction takes some time to develop. Where the spread of gas gangrene is being arrested in muscle, great leucocytic invasion is present. This is well shown in Fig. XII, taken from a muscle in an amputation stump. Here a recrudescence occurred in the stump, but was arrested after spreading a few inches only. Macroscopically a very definite pale zone was visible, and in section abundant phagocytosis of bacilli by polymorphonuclear leucocytes was found.

Control Experiments on Animals.

A considerable number of experiments have been carried out in animals to control the conclusions arrived at by the study of human tissues. Large rabbits were used, because

of their long hind legs, in which the spread of the disease could be watched at different stages. Gas gangrene being a disease of muscle, all the inoculations were made intramuscularly into the gastrocnemius or soleus. Several facts of considerable interest were brought out:

1. A spreading gas gangrene of the limb, quite comparable with the same disease in man, could be produced in rabbits, sometimes leading to a fatal result.

2. The surest method of inducing this result was by the injection of about one cubic centimetre of the fluid expressed from a human muscle showing fairly advanced gas gangrene. This fluid contained abundant bacilli, and all the products of tissue disintegration.

3. When the fluid obtained in this way was first passed through a Berkefeld V filter to remove the organisms, intramuscular injection led to marked local necrosis of muscle fibres, accompanied by considerable leucocytic reaction. No spreading oedema or separation of muscle fibres at all comparable with that described in human tissues could be brought about.

4. A rapidly spreading fatal gas gangrene was produced in one instance only by the injection of a pure culture of *B. perfringens* isolated in culture from a fulminating human case. In this experiment a haematoma of considerable size had been caused in the muscle at the site of inoculation, and this may have provided the dead tissue necessary to start the spreading disease. In tissues from this animal all the changes noted in the spreading margin of the disease in man were perfectly and completely reproduced. In some sections normal fibres were seen lying side by side with others of a deep eosin tint and separated off from the reticulum. At another place the appearances corresponded exactly with those shown in Fig. X, the sharpness and regularity of the interstitial network being very striking.

5. Other experiments carried out with pure cultures of *B. perfringens*, isolated from human cases, led only to a local gangrene at the seat of inoculation, round which a zone of granulation tissue quickly formed, completely walling off the damaged tissue.

CONCLUSIONS.

1. The rapidity of spread of gas gangrene into living voluntary muscle is so remarkable as to require explanation by a different process from that which governs ordinary septic invasion of tissues.

2. It is suggested that the facts are accounted for by the peculiar anatomical structure of muscular tissue. The sheaths enclosing the long individual fibres are so easily detachable as to form potential spaces into which toxic material can readily pass, causing necrosis of the fibres.

3. The early selective invasion of single muscles is consistent with the above view.

We wish to thank Colonel Cuthbert Wallace, C.M.G., consulting surgeon, for his help and interest in this work. The drawings from microscopic sections were made by Sergeant A. K. Maxwell, R.A.M.C., working under the auspices of the Medical Research Committee.

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THE SUCCESSFUL CONSERVATIVE TREATMENT OF EARLY GAS GANGRENE IN LIMBS BY THE RESECTION OF INFECTED MUSCLES.

BY

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AMONG the points brought forward by Colonel Cuthbert Wallace in an article on gas gangrene[1] published in this JOURNAL some months ago were the following:

1. It is rare to meet gas gangrene without muscle injury.

2. It is chiefly a disease of muscles, and is rarely dangerous unless muscle is involved.

3. The lesion in its early stages may be described as a longitudinal one, running up and down the wounded muscles from the seat of the lesion. Muscles, or groups of muscles, are involved, while others escape.

4. It is rare to find all the muscles of a segment of a limb involved, save in a segment distal to one in which the main blood supply has been cut off. Thus the whole leg dies and becomes gaseous when the femoral artery has been blocked in the thigh.

5. There is little tendency for the infection to pass from one muscle to another. This is well shown in amputation stumps, where one muscle dies and becomes gaseous, while the rest of the cut muscles remain healthy.

From our own observations in clearing stations over a period ranging up to twenty-one months it is abundantly clear that these points cannot be controverted. In no case have we seen gas gangrene commencing as a subcutaneous infection; injured muscle is in all cases the initial focus, the appearance of crackling in the subcutaneous tissues being a secondary phenomenon, due to extravasation of gas from the infected muscles below.

RESECTION.

In view of this, it has been our aim to model our treatment on the following lines as soon as the condition is diagnosed: To explore the primary focus with a view to attempting to arrest the infection in the muscle, or group of muscles, involved by resection of the infected areas. Such resection may, as will be seen from the cases, involve a part or the whole of single muscles, or groups of muscles.

Resection should be limited to cases in which the main vessel of the limb is intact, and should be replaced by amputation where the operation must be so extensive as to be likely to give a limb which would be of less value than an artificial limb. Extensive resections, however, may be performed regardless of the ultimate utility of the limb as a life-saving operation, it having been quite clear in some of the cases recorded below that an amputation, as in Case XIII, or a further amputation, in Cases VII and IX, could not have been carried out without very grave risk to life. Resection should extend until muscle is reached which has the following characteristics:

1. The colour is unchanged.
2. The contractility is normal.
3. A good blood supply is present, as indicated by free bleeding from the cut surface.

Experience has shown that even if such muscles are, as they may be, slightly infected, free drainage and an open wound will arrest further development of the condition.

After-Treatment.

The treatment of cases after resection is carried out on the following lines: (1) The dressings are reduced to the absolute minimum—that is, one or two layers of gauze only are placed over the wound so as to allow free access of air and, if possible, sunshine to the wound region; (2) constant or intermittent irrigation of the wound by some modification of the Carrel method—eusol, saline, or hydrogen peroxide being used as the irrigating fluid.

In connexion with the cases described below, the point must be specially emphasized that gas gangrene had already developed in some patients, though they were admitted a very short time after being wounded. In fact, in units at the front established gas gangrene has to be treated *ab initio*, in addition to gas gangrene developing at a later stage.

We are indebted to Colonel Cuthbert Wallace, consulting surgeon to this army, for advice and assistance in the treatment of these cases, and to Captain J. W. McNee and Lieutenant J. S. Dunn, of No. 3 Mobile Laboratory, R.A.M.C., for the bacteriological and pathological investigations they have made in the cases.

CASE I.

Lieut. F., wounded 4 p.m. on November 2nd, 1916, by rifle grenade fragment; admitted at 7.15 p.m. the same day, that is, three and a quarter hours after being wounded.

When admitted he was clearly very ill, although he arrived as a walking case; his pulse was 120, of poor quality and irregular, his tongue was furred, and his features pinched and worn. There was an irregular wound the size of a threepenny-piece (that is, about 1.6 cm. in diameter) on the posterior aspect of the right arm just above the internal condyle of the humerus; there was no exit. The whole upper arm appeared

swollen; it was crepitant to the touch, and gave a tympanitic note on percussion. The crackling was most marked on the inner aspect of the arm, and extended as high as the anterior axillary fold above in front, but to not quite so high a level behind.

He was given a general anaesthetic at 8 p.m. The wound of entry was first excised; much damage to the triceps was found locally, and the projectile could be felt to the inner side of the vessels in the front of the arm at the junction of the lower and middle thirds; a second incision was made over this, when the subcutaneous tissues were found to be oedematous, and the biceps muscle showed evidence of gas infection. A further incision was accordingly made along the whole length of the biceps muscle from its origin to attachment; this showed the following conditions: some bruising of the inner border of the muscle at the situation of the projectile; discoloration of the inner half of the muscle, varying from a dull red colour at either end to a deep plum colour in the centre. Over the discoloured area bubbles of gas were present under the fascia covering the muscle. This half of the muscle did not react to tap stimulation, whereas the outer half was normal in colour, and contracted sharply on stimulation. As this appeared to be an infection localized to the inner half of the muscle, the latter portion was resected in its entirety.

A tube drain was inserted into the posterior wound; the anterior wounds were left open, small tubes being inserted for continuous eusol irrigation, which was commenced immediately after the operation was completed. The pulse dropped to 88 six hours afterwards and never rose above this again. The wounds remained clean without pus formation, and on November 9th were closed by secondary suture and the eusol irrigation discontinued. The wounds remained healthy and were practically healed when he was evacuated to the base on November 17th. He had already very fair power in his arm and the remaining portion of the biceps could be felt contracting.

Pathological Report.—An anaërobic gas-forming organism was grown from the excised muscle, which, on histological examination, showed hyaline degeneration of groups of fibres with separation. This condition represents a very early stage in the process of gangrene. Long bacilli could be recognized between the muscle fibres, but they were very scanty.

The extreme rapidity of the infection in this case is remarkable, occurring as it did within three and a quarter hours of the time of injury. It was, in fact, the earliest case we have ever seen. There is no doubt that if any delay had occurred in the treatment the consequences would have been disastrous owing to the virulence of the infection; the patient would have lost his limb if not his life. The treatment by resection of half of the muscle rather than the whole, which at first sight would seem to have been the better course, was due to the fact that the infection is known to spread longitudinally along the length of the fibres and that transverse spread is a late phenomenon occurring in the more advanced stages. The differentiation between living and dead portions of the muscle was made from the presence or absence of contractility, it being well established that heavily infected muscle is non-contractile. (C. H. S. F.)

CASE II.

Lance-Corpl. D., wounded by shell fragment on July 2nd, 1916, was admitted twenty-four hours later, when the following condition was found. Temperature 102.6°, pulse 118; there was a through-and-through wound in the middle of the left upper arm; the arm was greatly swollen in the neighbourhood, and tender on palpation. Subcutaneous crepitation was present.

At the operation, which was performed at once, the biceps muscle at the site of the wound was found to be in a state of "black death," and was full of gas; for two inches above and below this the muscle was non-contractile and in the "red death" stage. A long incision was made over the whole length of the biceps and the entire muscular portion was excised. The wound was dressed with gauze soaked in peroxide until all oozing had ceased, and then was left exposed to the air and sun under a single layer of gauze.

The patient vomited a good deal for two days after the operation, but on the third day this ceased, and his temperature and pulse dropped to normal, and remained so. No other muscle was affected, and the resection was entirely curative, and conserved his limb. He was sent to the base on July 11th with a healthy granulating wound, and a satisfactory report on his condition was received from England on July 26th. (G. E. N.)

CASE III.

Pte. O. was admitted at 7.30 p.m. on October 29th, 1916, suffering from multiple shell wounds received the same afternoon. His general condition was good; there was a penetrating wound of the right chest, an in-and-out wound of the right calf, and a penetrating wound of the right biceps muscle.

The next day he was given a spinal anaesthetic, and the wound in the leg was incised and drained. On the following day his condition was not so good, and he complained of pain in the right arm; pulse 106, temperature 101.8°. The wound in his arm was the size of a sixpence (1.9 cm.), and was situated over the centre of the biceps muscle. The arm was swollen, and the skin was tense and slightly discoloured in the region of the wound. On gentle pressure a small amount of dirty serum with gas bubbles in it escaped from the wound. A general anaesthetic was given, and the biceps muscle exposed by a long incision. In the middle third of the muscle, deeply situated, there was a small cavity containing a fragment of shell; above and below this for a distance of two inches was an area of dead crepitant muscle. The whole necrotic area was excised until healthy muscle was reached, which bled on section. The wound was left freely open, and dressed with eusol gauze.

He made a straightforward recovery, and was evacuated to the base on November 12th. The wound in his arm was then healthy and ready for secondary suture.

In this case immediate improvement followed resection of the infected muscle. (H. D.)

CASE IV.

Pte. G., wounded on July 24th, 1916, was admitted the same day with shell wounds of the right buttock, right calf, and skull.

Immediate operation by trephining; wounds of buttock and calf drained and a piece of metal removed from the soleus muscle.

Twenty-four hours later the calf was very swollen and tender and gas bubbled from the wound on pressure; the temperature was 102° and the pulse 112. An anaesthetic was again given and the calf opened up from the lower part of the popliteal space to 3 in. from the ankle. The gastrocnemius was split down the mid-line and found to be healthy and contractile; the soleus beneath along the track of the projectile was found to be in the "black death" stage of gangrene; it was crepitant and no part of the muscle was contractile. As much as possible of the muscle was cut away and the wound was flushed out with peroxide and left open to the air, the limb being slung in a cradle for this purpose. The patient was given 100 c.cm. of 5 per cent. eusol solution intravenously at the end of the operation.

Rapid improvement followed; the temperature and pulse dropped to normal on the next day, and he was evacuated to the base on July 30th, with normal temperature and pulse. The head wound had healed and the other wounds were clean.

A note from the base hospital stated that he was sent to England on August 5th, 1916, having made an uninterrupted recovery. (G. E. N.)

CASE V.

Second Lieut. G., wounded in the left leg by a rifle bullet at close range at 2.30 a.m. on October 11th, 1916; he was admitted at 9 a.m. and operated on immediately.

There was a through-and-through wound in the upper and outer part of the left calf, the wounds of entry and exit being of about the same size and just large enough to admit the tip of the finger. The wounds were excised and freely drained by means of two large tubes after irrigation with eusol; the wound appeared to be a comparatively trivial one.

Eighteen hours later the pulse, which had been previously normal, ran up to 120, and he showed signs of profound toxaemia; the upper part of the leg was swollen and tender and the skin was glazed; there was no subcutaneous crackling. An anaesthetic was again given and the entire track of the wound, which was about three inches long, was laid open by division of skin and intervening muscles. The peroneus longus and brevis muscles were found to be considerably lacerated; they were altered in colour, crepitant, and non-contractile. The dead portions were cut away until healthy bleeding muscle was reached, which contracted on stimulation. The wound was left open and treated with continuous eusol drip irrigation.

Immediate improvement followed, the pulse dropping to normal within a few hours. He was evacuated to the base nine days later with a healthy granulating wound.

Anaërobic gas-forming organisms were found on culture in the dead muscle removed.

This case is of interest, as the infection commenced in spite of free and early drainage. Resection of the infected area cut the process completely short. (C. H. S. F.)

CASE VI.

Corpl. E. was admitted at 5.30 p.m. on August 27th, 1916, having been wounded by a shell fragment at 7 p.m. the previous day. On admission he looked flushed, the tongue was dry, the pulse 126, and the temperature 103°. There was a wound of entry the size of a shilling (2.3 cm.) over the anterior tibial group of muscles at the junction of the middle and lower thirds of the leg; the wound of exit was 2 in. above the ankle-joint on the posterior aspect of the limb in the middle line. The missile had passed between the two bones of the leg. The limb was very swollen in its lower half and the skin had a white, tense, glazed appearance; there was considerable pain on palpation. No subcutaneous crackling was elicited.

On raising the limb under the anaesthetic, gas bubbles escaped from the anterior wound with some foul stinking serum. The skin wound was excised and the anterior tibial group of muscles were explored through a 6 in. incision. The extensor longus digitorum muscle was exposed, this had been divided across by the missile; the retracted ends showed an opaque sheath with underlying dead non-contractile muscle for an inch on either side of the wound. The dead portions were cut away until normal vascular muscle was reached at either

end. About two and a half inches in all were cut away from either end; the anterior tibial artery was exposed at the bottom of the wound, but was uninjured. The extensor longus hallucis looked healthy and contracted well. The posterior muscles were not markedly damaged and were not interfered with. The wound was drained and drip irrigation with eusol commenced.

The patient made an uninterrupted recovery, and was evacuated to the base on September 3rd; his pulse was then 90 and his temperature 99°. The wounds were granulating.

An anaërobic gas-forming organism was isolated from the removed muscle, which, on section, showed necrosis and irregular fragmentation of muscle fibres; there was oedematous thickening and leucocytic infiltration of the interstitial connective tissue. Large bacilli were present in considerable numbers between the dead fibres.

This case clearly shows the longitudinal spread of the infection in the muscles and how free resection of the diseased muscle arrests any further spread of the infection. (H. D.)

CASE VII.

Pte. C. was wounded at 4 p.m. on July 29th, 1916, by a shell fragment in the region of the left knee. On admission five hours later his condition was very bad owing to loss of blood; the pulse was 150.

Six hours later after warmth and stimulation he was fit for operation, and the wound was explored. There were two lacerated wounds on each side of the popliteal space which had evidently been traversed from within outwards; examination showed an extensive fracture of the head of the tibia involving the knee-joint. The pulsations of the main vessel could not be felt; the gastrocnemius and soleus muscles were extensively lacerated. The wound was freely drained after irrigation with eusol.

The next day his condition was satisfactory until 8 p.m., when his pulse was 120 and his temperature 102.4°. The region of the wound was more swollen and the skin over the calf had the appearance of a bruise which was fading; percussion gave a tympanitic note over this area; there was no subcutaneous crackling. The knee-joint was also resonant from the presence of gas. The lower third of the leg was cold, and there were several light purple patches over the dorsum of the foot.

The leg was removed by disarticulation at the knee-joint; examination showed occlusion of the popliteal artery from a bruise wound and a large hole in the popliteal vein—the gastrocnemius and soleus muscles showed marked gas gangrene.

He was much improved the next day, but on the following day his pulse was 120, and his temperature 101.4°; the lower third of the thigh was swollen, tender to the touch and resonant to percussion; it was evident that the infection was spreading up the muscles of his thigh. Under chloroform an incision was made up the back of the thigh and the semimembranosus muscle was found to be gaseous and stinking. It was followed up to the middle of the thigh and resected at this point as the fibres were found to be healthy there. The anterior aspect of the thigh was then explored and the sartorius muscle found to be similarly infected in its lower part; the distal four inches were resected through healthy muscle.

The wounds were left exposed to the air, being covered by one layer of gauze only; the wound was kept irrigated by a constant eusol drip. The thigh was slung so as to take the weight off the muscles of the back of the limb; suspension was effected by means of a gauze band attached to the exposed condyles of the femur. From this time on he commenced to improve; on the following day his pulse was 96 and temperature 101°. On August 3rd the stump of the popliteal artery, which was lying in a bed of sloughing muscle, commenced to ooze; in order to avoid a secondary haemorrhage the femoral artery was ligated in Hunter's canal under local anaesthesia. After this he continued to improve, and was evacuated to the base on August 15th.

The muscles were infected with a pure culture of *B. perfringens*.

It was impossible even to attempt to save the limb in this case by resection of muscle in the first instance owing to the occlusion of the popliteal artery. When the secondary spread of infection occurred into the thigh muscles after the amputation his general condition became rapidly so bad that a further amputation would have been inevitably fatal. Resection of the infected muscles was the only satisfactory course to adopt, as proved to be the case. (H. D.)

CASE VIII.

Pte. P., wounded August 28th, 1916, was admitted the same day. There was a through-and-through wound of the left thigh, with compound fracture of the femur in the upper third. He had had much haemorrhage before admission, and was very collapsed on admission; pulse 140, temperature subnormal.

Twelve hours later he had improved sufficiently for operation; both wounds were freely opened up, lacerated muscle, fragments of bone, and the case of a bullet being removed. The outer wound was kept open with a silver retractor, and both were lightly packed with eusol gauze. The limb was immobilized on a Wallace-Maybury splint, and the wounds were syringed every two hours with eusol.

The patient had a good night, but next morning his temperature and pulse began to rise; he complained of pain in the limb and of great thirst, and the tongue became dry and brown. The limb was found to be swollen and tense, and had a characteristic odour. There was no skin crepitation and no gas bubbles from the wound. An immediate "chaff-cutter" amputation just below the trochanters was performed; as the adductor muscles were found to be in the red stage of gas gangrene, they were completely excised from the stump. The wound was dressed for twenty-four hours in gauze soaked in peroxide, and then left exposed to the air under one layer of gauze.

Within two days the temperature dropped to normal and the pulse to 90; none of the other muscles in the stump showed any sign of being infected, and he was evacuated to the base on September 15th with a granulating wound.

A laboratory report confirmed the diagnosis of gas gangrene.

This method of removing a group of infected muscles was also carried out in another case five days after amputation, the adductors here being also removed. No spread occurred in the other muscles. (G. E. N.)

CASE IX.

Lieut. B., wounded at 1 a.m. on September 13th, 1916, by shell; the right leg was shattered in the lower third. He was admitted at 3.30 a.m. the same day.

Primary amputation by equal lateral flaps at the middle of the leg was performed at 4 a.m. It was noticed at the operation that the anterior tibial artery was occluded; there was no change in the muscles, which were contractile and apparently healthy. The wound was freely irrigated with eusol, and the flaps which were free were united loosely with three sutures. Free drainage was provided by means of two tubes, which also served for constant eusol irrigation, which was started at once. The pulse before the operation was 90; at the end it was 88.

Twenty-six hours later the pulse ran to 120, the tongue became furred and dry, and the patient was drowsy and obviously very ill. Examination of the wound showed mottling of the skin over the front of the leg, together with a tympanitic note on percussion over the same area; there was no crackling of the subcutaneous tissues. The wound was at once opened up, when it was found that the entire anterior tibial group of muscles were a brick-red colour, non-contractile, and quite dead. They were removed *en masse* and the wound was left open under constant eusol drip irrigation.

The general condition remained bad for twenty-four hours, with rapid pulse, drowsiness, and persistent vomiting. Steady improvement then followed, and the patient was sent to the base on September 22nd with a healthy granulating wound.

The removed muscles were found on culture to be heavily infected with gas-forming organisms.

The only other alternative in this case would have been a further amputation through the thigh, which it is doubtful if the patient would have survived. Resection of the muscles avoided this additional danger and gave the patient a much more serviceable stump, as the knee-joint was saved. (C. H. S. F.)

CASE X.

Pte. P. was wounded by shell fragment on July 23rd, 1916. When admitted on July 24th the temperature was 103.6°, and the pulse 120. There was a through-and-through wound of the left thigh, the entry being on the inner side, 3 in. above the patella, and the exit 2 in. higher up on the outer side. The exit wound was swollen, tense, and tender, but did not crepitate.

Both wounds were excised and united by incising the skin. There was some laceration of the edge of the vastus internus; this was cut away; the muscle looked normal, and was contractile. The rectus femoris was grooved on its under surface, but appeared otherwise normal. The exposed inner edge of the vastus externus was brick-red and non-contractile, and smelt strongly of gas gangrene. An area of 4 in. by 2 in. of the muscle showed signs of red death; the parts beyond were normal and contractile. A free skin incision was made, and a piece of muscle 8 in. by 3 in. enclosing the affected area was excised. The wound was dressed in gauze soaked in peroxide, and later exposed to sun and air.

The temperature and pulse steadily fell, and by July 30th were 99° and 76 respectively. He was sent to the base on that day; the wound was then healthy and granulating, and there was no sign of further gas infection.

A report from the mobile laboratory stated that the infection was due to an anaërobic gas-forming organism. (G. E. N.)

CASE XI.

Pte. M., wounded on August 29th, 1915, by shell fragment in the left groin. There had been much haemorrhage at first, necessitating saline infusion in the field ambulance, where he was retained until midday on August 31st.

On admission his condition was grave; tongue brown and dry, pulse 130. There was a ragged wound of entry the size of a shilling (2.3 cm.) an inch and a half below Poupart's ligament and just to the inner side of the femoral vessels; the skin over the upper third of the thigh and for a handbreadth above Poupart's ligament was mottled and discoloured, and showed marked subcutaneous crackling.

An anaesthetic was immediately given, and the wound opened up; it was found to extend upwards and outwards towards the anterior superior spine, where a fragment of metal and khaki

was found in the sartorius muscle. The muscle in this situation was dead, and the upper third was cut away. The discoloured and crepitant areas were incised down to deep fascia, and freely injected with hydrogen peroxide. No dressing was applied, and the wound was kept constantly irrigated with hydrogen peroxide and left exposed to the air and sun.

Rapid improvement took place, and the man was evacuated to the base with a granulating wound twelve days later. No bacteriological examination was made, but there was no doubt about the condition.

At the time when this case came under treatment the significance of the muscle resection was not realized, but it seems at least probable that it cut short the process by removing the main focus of infection. (C. H. S. F.)

CASE XII.

Lance-Corpl. C., wounded in the left thigh by a shell fragment at 3 p.m. on March 13th, 1916, was admitted into hospital at 2.30 p.m. the following day.

On admission he looked flushed, the temperature was 102°, and the pulse 120. There was a jagged wound two inches long on the outer aspect of the lower third of the left thigh. There was no exit wound. The lower part of the left thigh was swollen and tense, and the overlying skin shiny. There was tenderness on palpation, and a tympanitic note was obtained on percussion; there was no subcutaneous crackling.

At 5.30 p.m. on the same day a long incision down the outer aspect of the thigh exposed the vastus externus muscle, of which the lower half was markedly affected with gas gangrene. A portion of the muscle near the wound of entry was black in colour and the muscle fibres were diffluent. The lower part of the muscle was resected up to the middle of the thigh, where healthy contractile muscle was found. As the muscle planes were separated by gas up to the level of the great trochanter, the skin incision was carried up to this level. The whole wound was left wide open and dressed with eusol gauze. At 9 p.m. the same evening he was given an intravenous injection of eusol 100 c.cm.

The pulse dropped the next day, and he showed great improvement; this was maintained, and he was evacuated to the base six days later. Information was received from England a week later that he was progressing well.

An anaërobic gas-forming organism was obtained on cultivation from the muscle removed. (H. D.)

CASE XIII.

Pte. B. was wounded by shell fragment on September 1st, 1916, and admitted the same day. There was a through-and-through wound of the thigh, the entrance being on the inner side two inches below Poupart's ligament and the exit at a corresponding point on the outer side.

Under an anaesthetic the skin wounds were excised and the track syringed with eusol and drained.

Fifteen hours later the patient complained of great pain in his thigh and of great thirst; the temperature was 101° and the pulse 110. The wound was found to be tender, crepitant, and gassy.

An anaesthetic was again given, and the whole track of the missile laid open; the sartorius, rectus femoris, and the inner edge of the vastus externus were found to be in the "black death" stage of gas gangrene. An incision was made from the anterior superior iliac spine to the knee and another along the inside of the thigh; these were stitched back to healthy skin so as to expose the wound fully. All three muscles showed the "black death" stage of gangrene at the site of the wound, toning down through the "red death" stage to normal muscle as the muscles were traced down the thigh. The muscular part of the rectus femoris was removed, and also the sartorius from its origin to just above the knee. A strip of the vastus externus for nearly its entire length and for a width of 3 in. was also excised. No other muscles appeared to be affected; the wound was dressed with gauze soaked in peroxide, and afterwards exposed to the sun and air.

For three days he was very ill, with rapid, feeble pulse, constant hiccough, and persistent vomiting; he however slowly improved, and on September 5th his pulse was 88 and temperature 100°; the hiccough still persisted. Two days later a part of the skin flap sloughed, after which he improved steadily, and was evacuated on September 11th with a healthy granulating wound, which was skin-grafted at the base hospital.

The diagnosis of gas gangrene was confirmed by the mobile laboratory. (G. E. N.)

CASE XIV.

Corpl. V., wounded in the left thigh by a shell fragment at 5.30 p.m. on September 19th, 1916, was admitted five hours later.

His general condition was good; pulse 100, temperature 99°. There was an entry wound the size of half a crown on the inner and posterior aspect of the thigh at the junction of the middle and upper thirds. The exit wound was at the outer side of the thigh in the middle third; it was very large, admitting the whole hand; the muscles were greatly lacerated. He was operated on immediately after admission; the missile had passed through the vastus externus and biceps muscles close to the femur, and had partially divided the sciatic nerve. The wound was freely drained after irrigation with eusol.

He continued to do well for two days, when the evening pulse rose from 104 to 132, and the temperature to 102°. The skin over the exit wound was now a dirty-brown colour, and the area in the neighbourhood was swollen and tender; there was no subcutaneous crackling. The skin discoloration extended to the popliteal space. A further anaesthetic was given, and the large exit wound was laid freely open. In the lower part of the wound the vastus externus muscle was found to be gangrenous; it was non-contractile and gaseous. The infected portion of the muscle was resected until healthy muscle was exposed. In the upper part of the wound the vastus externus was pale and contracted feebly; with clean instruments a piece was removed for examination, and the skin was laid freely open over the muscle. Eusol dressings were used.

Immediate improvement followed, and he was evacuated to the base on September 26th, with a normal temperature and pulse.

Anaërobic gas-forming organisms were cultivated from the dead muscle, and were also obtained on culture from the portion of muscle removed from the upper part of the wound.

This case shows the immediate improvement after resection of the infecting focus, and also that muscle may look healthy and be contractile, and yet be infected. (H. D.)

REFERENCE.

[1] Gas Gangrene as Seen at the Clearing Stations, BRITISH MEDICAL JOURNAL, September 16th, 1916.

Memoranda:

MEDICAL, SURGICAL, OBSTETRICAL.

PNEUMONIA AND TOXAEMIA.

IN the JOURNAL of May 5th, 1917, Captain Drew emphasized the distinctions between the local lesion of pneumonia and its toxaemia; and suggested lumbar puncture in highly toxic cases. The following case, recently in this hospital under the care of Professor Sir Clifford Allbutt, illustrated with almost singular clearness the distinction in question, and the doctrine then insisted upon by the Regius Professor that, speaking within limits, the toxic symptoms of pneumonia do not correspond in degree with the extent of local lesion, and that a small, almost a latent, patch of pneumonia may be attended by severe and even mortal toxic symptoms.

The case to be related illustrates the contrary side of the comparison; a very severe and extensive local lesion was attended by no toxic symptoms whatever.

M. H., female, aged 22, was admitted on March 14th, 1917. She had never before had a severe illness. Her temperature after the first few hours was 103°, the pulse 104, and the respirations 36. The attack began three days before, with vomiting; but she had, till admission, gone on with her duties as a V.A.D. nurse. She was sent into the hospital because of her temperature. Two days later crisis occurred sharply; the temperature, respirations and pulse falling to the normal in the course of a day or two. Pneumococci were found in the sputum. So far there was nothing unusual about the case. The remarkable thing was that during all this time the young woman seemed fairly well. Her face was a little flushed, but she betrayed no sign whatever of distress. There was no sense of dyspnoea, she sat upright in bed, and moved easily into any attitude. There was no loss of appetite, no debility, no nervous disorder, but good comfortable sleep. She was quite cheerful and chatty, and it was difficult to persuade her she was really ill.

Yet on physical examination the left lung was dull throughout and typical fine crepitation heard over the whole of it, front and back, but especially over the lower half behind. So startling was the contrast between symptoms and signs that until the crisis came the fear of acute tuberculosis could not be dismissed. The extent and severity of the lesion was proved by the slow disappearance of the signs of consolidation and the long persistence of crepitatio redux. However in about three weeks the pneumonia had disappeared, though during convalescence, on account of a mild attack of tonsillitis, then prevalent in the ward, her discharge was delayed. She went out quite well, and returned to her duties, scarcely having been "ill in herself" throughout.

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Reports of Societies.

ETIOLOGY OF TYPHUS FEVER.

AT a meeting of the Section of Epidemiology and State Medicine of the Royal Society of Medicine, on May 25th, Colonel J. LANE NOTTER, Vice-President, in the chair, Miss MURIEL ROBERTSON (Lister Institute) read a paper on recent researches into the etiology of typhus. After a brief historical sketch, Miss Robertson considered in detail the experimental work initiated by the investigations of Nicolle in 1909. She called attention to the numerous contradictory assertions made by competent investigators, and pointed out that one of the sources of these discrepancies had been failure to allow for the fact that a considerable proportion of monkeys, the experimental animals mostly employed, possess at least a transient immunity, and that among monkeys kept in captivity small variations of temperature are quite common, so that, without careful preliminary investigation, erroneous inferences may be drawn from temperature charts. The work of Nicolle, Conor, and Conseil, and that of Anderson and Goldberger and of Ricketts and Wilder was described. The conclusion was drawn that no satisfactory proof had been provided of a monkey exhibiting a typical typhus reaction after the injection of filtered serum from a typhus patient, and that the present state of knowledge authorizes the belief that the virus of typhus will not pass a sound Berkefeld filter. Passing to the supposed bacterial causes of the disease, the opinion was expressed that the organism isolated by Plotz in 1915 from guinea-pigs infected with Anderson and Goldberger's strain of the virus, and subsequently incriminated by Popoff, who investigated an epidemic in Macedonia, by Olitzky, and by Denzer and Husk in Mexico, had better claims to be regarded as the causative agent than any other organism so far described. It was, however, pointed out that there were weak links in the chain. Thus, cultures isolated did not produce a convincing form of the disease in inoculated animals, while the development of specific agglutinins for the organism during the natural disease, as observed by Popoff, was not a conclusive proof. Reference was also made to the description by Prowazek of intraleucocytic bodies staining intensely by Giemsa's method, which appeared about the third day of the disease, and were also found in experimentally infected monkeys. The work of Nicolle and his colleagues on transmission by body lice in monkeys was described, as were the generally confirmatory results of Ricketts and Wilder, and of Anderson and Goldberger. One curious point emerged from these experiments—namely, that while a full dose of virulent blood did not immunize unless it produced a febrile reaction, in transmission by lice the monkey was apparently immunized without the production of a febrile reaction. The blood of such a monkey, if injected into another monkey, failed to produce infection. Finally, reference was made to the recent work of Sergent, Foley, Violatta, and Rocha-Lima. Their results appeared to confirm the findings of Prowazek, so far as the existence of bodies staining intensely by Giemsa's method was concerned, but Rocha-Lima believed them to be bacterial; more recently, however, he had provisionally classified them as Chlamydozoa, and introduced the name *Rickettsia prowazekei*. Rocha-Lima's louse transmission experiments were positive, but, so far as the optimum temperature at which the lice should be kept was concerned, his results were in direct conflict with those of Nicolle and his colleagues, Ricketts and Wilder, Anderson and Goldberger.

In opening the discussion, Dr. JOHN BROWNLEE commented upon the fact that some confusion still apparently existed as to the differentiation of typhus, particularly with regard to critical phenomena. His experience at Glasgow led him to support the hypothesis of transmission by lice. In his opinion, little importance attached to statements in the older literature respecting the variable fatality of the disease. There had been in some cases confusion with cerebro-spinal fever and in others with relapsing fever. The results of a considerable number of animal experiments he had performed were not convincing. He had also found in the blood intraleucocytic appearances somewhat suggestive of Prowazek's bodies. His experience of serum therapy had not been satisfactory.

Lieutenant-Colonel E. W. GOODALL agreed with Miss Robertson and Dr. Brownlee as to the need for caution in interpreting temperature charts. Only one case of typhus had occurred in his ward staff, and it was, in his opinion, difficult to attribute that case to lice; he thought that the head louse was a much less probable source of infection than the body louse.

Captain A. G. R. FOULERTON thought that the case against the body louse was proved; all evidence collected since the date of Nicolle's first papers tended in the one direction. He did not think that Plotz's bacillus was the causative agent of typhus, immunizing experiments having failed.

Mr. A. W. BACOT thought that what was now known respecting the life history of the louse was quite consistent with its being a transmitting agent. The question of the degree of infestation was important. It was well known that men or animals weakened by fatigue or hunger rapidly ceased to attempt to free themselves from the parasites.

Captain GREENWOOD observed that the literature contained several suggestive cases consistent with the louse theory, although not conclusive. The special incidence of typhus as well as dysentery upon the English troops before Dundalk in 1689 as contrasted with the immunity of the Dutch soldiers was interesting. The Dutch were seasoned troops, well hutted, while the English were described by a contemporary as negligent and dirty, "many of them, when they were dead, were incredibly lousy." There was also a case in the Irish epidemic of 1817–18, when the inhabitants of the island of Rathlin, although equally famine-stricken, did not share in the epidemic which ravaged Antrim.

Lieutenant BARRIE remarked that his experience in Serbia absolutely confirmed the louse theory of transmission. Measures leading to the mitigation of lousiness had an immediate effect. Clinically, among other features of interest was the occurrence of ambulant cases. With regard to the fatality, some experienced Balkan observers did not agree with the view that relapsing fever was much less fatal.

The CHAIRMAN, in closing the discussion, while recognizing the great importance of the louse problem, expressed the opinion that other parasites also demanded attention, particularly bugs.

Reviews.

GYNAECOLOGY.

THE *New System of Gynaecology*,[1] edited by Dr. T. W. EDEN and Dr. CUTHBERT LOCKYER, is an imposing work in three volumes quarto, with over 2,500 pages, freely illustrated, and containing articles by numerous authors. In the preface to this important work the editors state that its design originated in the belief that the time had come to put into concrete form the great changes through which gynaecology in this country has passed in becoming a special branch of surgery "during the last ten years." We think this statement is not historically accurate. Gynaecology has always been a special branch of surgery, and there is perhaps no gynaecological operation now performed which was not performed by gynaecologists long before ten years ago. Again, the editors state that "the old view that the gynaecologist is a physician, not a surgeon, is no longer tenable." We doubt whether any thoughtful person ever held this view. Gynaecologists have always done work which may partly be called physician's work and partly surgeon's, and still do such work. The old title by which the teachers of gynaecology were known, obstetric physicians, is no doubt unsuitable; but it has never meant that they only practised as physicians; in the nature of things they cannot do so, but we note that both the editors and many of the contributors of surgical articles are called obstetric physicians in the list of authors.

[1] *The New System of Gynaecology*. Edited by Thomas Watts Eden, M.D., F.R.C.S.E., F.R.C.P.; and Cuthbert Lockyer, M.D., B.S., F.R.C.S., F.R.C.P. London: Macmillan and Co., Ltd. 1917. (Cr. 4to, Vol. I. pp. xv + 761; Vol. II. pp. vi + 875; Vol. III. pp. viii + 871. Numerous illustrations in colour and in black and white. £6 6s. three volumes.)

The editors rightly point out that it is incumbent on a gynaecologist to familiarize himself with the technique of certain problems of general surgery which often have to be solved in gynaecological work, and they do well to emphasize the importance of a practical knowledge of obstetrics in the training of a gynaecologist, and rightly state that gynaecology has suffered in the past (and they might have added still suffers) from the incursions of those who are not qualified by this training to understand its clinical problems aright.

The editors have thought well to bring general surgical conditions (of the kidney, bladder, rectum, vermiform appendix, intestinal complications, and female breast) into this *System of Gynaecology*. The articles on these purely surgical subjects have been written by general surgeons, and they unduly increase the size of the work without adding anything which is not available in the general surgical textbooks. In our opinion, the space would have been more usefully employed had the editors arranged for a full bibliography at the end of all the gynaecological articles, which constitutes one of the great advantages of Veit's *Handbook of Gynaecology*, with which this new *System* may be, in many respects not unfavourably, compared.

Volume I.

The article on the anatomy of the female pelvic organs is written by Professor Elliot Smith and Dr. J. S. B. Stopford. It gives a good but, for a gynaecological work, somewhat brief account of the subject, illustrated by figures of very unequal merit. Fig. 18 is a photograph of a poor specimen of the uterus and broad ligaments, and Fig. 23 is a very rough drawing showing the hydatid of Morgagni attached to the upper wall of the Fallopian tube and the vertical tubes of the epoöphoron converging to the middle third of the ovarian hilum, positions which those structures are rarely found to occupy. Dr. Louise McIlroy gives an excellent account of the physiology of the female reproductive organs. Micro-organisms in the female genito-urinary tract are dealt with by Dr. Ernest H. Shaw in a good and beautifully illustrated chapter. Dr. Beckwith Whitehouse writes on methods of examination. The text is good and many of the illustrations are excellent, but Fig. 78 gives an inaccurate representation of the lower hand in bimanual examination; although the illustrations are good, we think it was hardly necessary in a work of this kind to give six large figures representing the use of the Sims speculum and sound. At the end of the chapter a reference is given to Volume II (it should be Volume III) for a description of dilatation of the cervix by tents, but in the chapter referred to nothing is stated about this valuable method. A short but clear account is given by Dr. Topley of the examination of the blood, including the Wassermann and Abderhalden reactions. In a chapter of 70 pages Dr. Ballantyne gives an admirable account of malformation of the female generative organs. Dr. Blair Bell has written a full and excellent chapter on function, and Dr. Blacker a very complete account of ectopic gestation, in which the methods of treatment are judicially considered. Other chapters in this volume, all attaining to a high degree of merit, are on septic infections, by Dr. C. Oldfield; gonorrhoea, by Dr. T. G. Stevens; tuberculosis, by Dr. Clifford White; inflammatory affections of the Fallopian tubes, by Professor Munro Kerr; pelvic cellulitis, by Dr. Fairbairn; and syphilis, by Mr. Arthur Shillitoe. Two articles on streptothrix infections and echinococcal invasions of the pelvis and pelvic viscera, by Dr. Taylor Young and Professor D. A. Welsh, of Sydney, form an addition of great value to our knowledge of these rare affections. The volume ends with a very brief chapter on nervous diseases associated with morbid conditions of the pelvic organs by Dr. Purves Stewart.

Volume II.

Dr. Berkeley writes a good account of the diseases of the vulva and vagina. No mention is made of the so-called hidradenoma nor of fibroma of the hymen; these chapters are clearly written and well illustrated, but would be improved by a bibliography. Chronic endometritis and erosion are dealt with by Professor B. P. Watson of Toronto. Chronic metritis and allied conditions, by Dr. Fletcher Shaw—a chapter with beautiful illustrations—deals especially with the microscopic appearances met with in those conditions. Professor McKerron writes on morbid involution. Professor Hastings Tweedy gives a short but excellent account of lacerations of the cervix. Dr. Lockyer's chapters on myoma and adenomyomata are of very high merit and add greatly to the value of these volumes. Both text and illustrations are admirable. No British author has dealt so thoroughly with myomata and the changes which occur in them. The chapter on adenomyomata is also excellent, and contains a very complete account of adenomyoma of the recto-genital space, on the origin of which we note that the writer's views have changed. Dr. R. W. Johnstone gives a very good description of sarcoma and endothelioma of the uterus. He alludes briefly to carcinoma sarcomatodes, but we have noticed no reference to carcino-sarcoma either in the text or index. Professor Thomas Wilson's article on cancer of the uterus claims attention on account of the wide experience of the author. The clinical portion of the article is excellent, but we think some of the pathological part is revolutionary. Professor Wilson wishes to drop the term squamous epithelioma, and speak instead of alveolar carcinoma. He says that examination of the growing edges gives no indication of the evolution of tumours from the natural epithelium, but, on the contrary, supports the view that the cancer grows by multiplication of its own elements. We do not agree with this view. Whence come "its own elements"? Examination of the growing edge of early cases we think clearly demonstrates the origin from the surface squamous epithelium, and the editors, who regard all cases of cancer of the cervix as of the squamous-cell type, must have read this portion of the article with some surprise. The whole article is written in a judicial spirit and with an engaging frankness and an independence based on personal research which will cause gynaecologists to give it their close consideration. Professor Teacher writes an excellent chapter on chorion-epithelioma, or, as he calls it, chorion-epithelioma malignum. It is a valuable summary of our knowledge of this interesting disease and contains important suggestions on the difficult subject of diagnosis. The chapter on backward displacements of the uterus is by Professor Chipman of Montreal, who writes in a broad spirit on the importance of general treatment and, in certain cases, of treatment by pessaries. The operations he recommends for the cure of these displacements are the "Gilliam," the "Baldy-Webster," the "Olshausen," ventrisuspension, and ventrifixation. He alludes to some of the disadvantages, but does not lay sufficient stress on the dangers of intestinal obstruction, which has caused fatal results in a large number of cases after the operations he describes. Dr. Fothergill writes the chapter on prolapse. The treatment by colporrhaphy and perineorrhaphy is well described and illustrated, but we find no mention of colpohysterectomy, which is a valuable means of treating severe cases of procidentia. Professor Swayne gives a full account of chronic inversion of the uterus and the various methods of treatment. The excellence of Aveling's repositor does not appear to be appreciated by the author, though, properly used, the repositor will undoubtedly cure nearly every, if not every, case of chronic puerperal inversion. Of cysts and tumours of the Fallopian tubes an admirable and full account is given by Dr. Lockyer. Dr. Herbert Williamson and Dr. Barris give an excellent description of tumours of the ovary.

Volume III.

This volume contains chapters on diseases of the breast, by Mr. C. C. Choyce; on the vermiform appendix, by Mr. Herbert Paterson; on methods of examination of the urethra and bladder, by Mr. Thomson Walker; on diseases of the rectum, by Mr. Lockhart-Mummery, and on intestinal complications, by Mr. Scott Carmichael. All these articles are written by general surgeons, and, though they attain a high degree of merit, we think they might have been considerably curtailed in a work on gynaecology which might quite as justifiably have contained articles on the stomach, duodenum, gall bladder, liver, spleen, and pancreas. Hernia in women is dealt with by Dr. Eardley Holland. Dr. Eden writes a very clear and comprehensive article on operative technique. Dr. Felix Rood contributes a short but excellent chapter on anaesthesia; we do not, however, find in it any mention of the most recent forms of gynaecological local anaesthesia, namely, the paravertebral and sacral. Professor Donald gives the result of

his large experience in a short but very good article on ovariotomy. Dr. Giles writes an excellent article on hysterectomy, the interest of which is greatly enhanced by the statistics he has obtained from twelve of the principal London hospitals of the mortality for operations for myoma and cancer. The broad results of these twelve hospitals (namely, 2.11 per cent. mortality for myoma, 3.76 per cent. for cancer of the body, and 13.1 (or 17.6) per cent. for Wertheim's operation for cancer) are gratifying evidence of the excellence of British gynaecological surgery. But the tables afford an illustration of the fallacy of statistics; for by comparing the number of operations and the results obtained by abdominal hysterectomy for cancer of the body (almost all cases of which are operable and operated on) with the operations for myoma and for cancer of the cervix (in which the operability rate varies with the operator), the conclusion is forced upon the reader that gynaecologists in some institutions treat by abdominal hysterectomy many early and simple cases of myoma which others would either not operate upon or treat by myomectomy or vaginal hysterectomy, and that some gynaecologists show little enthusiasm for extending the beneficial effects of the extended abdominal hysterectomy for cancer of the cervix to any but a very small proportion of the cases seen. The difference in the mortality statistics is thus in part explained. Thus, for the twelve hospitals, the mortality for abdominal hysterectomy for cancer of the cervix varies between 0 and 31.4 per cent., but whereas the ratio of operations for cancer of the cervix to those for cancer of the body is 86 to 7 in the institution with the high mortality, the ratio in the institution with 0 mortality is 12 to 16, and this is the only institution in which fewer cases of cancer of the cervix than of cancer of the body are operated on by abdominal hysterectomy. In regard to prognosis, the writer makes two assertions which we cannot accept: one, that the fate of the cervical stump after supravaginal hysterectomy "need cause no apprehension"; the other, that the permanent cures of carcinoma of the body "even after many years may be put down at 95 per cent." Professor Wilson, in the second volume, shows that his own rate of absolute curability is 24 per cent., and Wertheim's 51.2 per cent. We believe the average rate of cure by experienced operators will be found somewhere between these two figures. Professor Munro Kerr writes an excellent article on operations on the gravid uterus. On page 531 we notice a misprint of Tait for Gow. Professor Howard Taylor's article on vaginal coeliotomy is good, but the operation is unnecessary for such a small submucous myoma as that shown in Fig. 244, which could be enucleated with ease and safety after dilatation of the cervix. A description of the "interposition" operation of Schauta-Wertheim is given, but the danger of embolism, which has occurred in several cases, is not mentioned. Fistula in the female genital tract is dealt with by Professor Hellier. The articles on minor operations by Dr. Bonney, after-treatment by Professor Franklin Martin, and general therapeutics by Dr. Amand Routh, are good. The volume ends with short chapters on radio-therapeutics in gynaecological practice by Mr. Lionel Provis and Dr. Robert Knox. We have nowhere found mention of the important fact that some of the German clinics have for several years practically ceased operating for cancer of the cervix, which is treated by radium, mesothorium, and Roentgen rays.

The *New System of Gynaecology* is highly creditable to British gynaecology. The printing, paper, and illustrations are admirable. The work would, in our opinion, be improved by curtailing the chapters dealing with general surgery, by the addition of bibliographies at the end of all the chapters, and by the provision of a full general index, the absence of which will be found a constant source of irritation. The indices at the end of each volume are not complete; for instance, none of them contains the Schauta-Wertheim or "interposition" operation for prolapse, which is described under vaginal coeliotomy, but only briefly mentioned in the article on prolapse. The *New System of Gynaecology* suffers from certain omissions, repetitions, even contradictions, inseparable from a work written by many authors; but in general excellence we have no hesitation in stating that it is the best work on gynaecology published up to the present time.

NOTES ON BOOKS.

A NEW volume of Methuen's Health Series has appeared from the pen of the general editor, Mr. BISHOP HARMAN, under the title *Staying the Plague*.[2] It is an attempt to show the public what venereal disease really is, how it poisons our social life, and what means are being taken and should be taken to remedy the mischief. On the principle that to understand aright the causes of an evil one must first know what is good, the author devotes his early chapters to a clean, sane, and pithy account of the relation of sex to the race, to the individual, and to human ideals. This leads on to a discussion of the causes and conditions of prostitution, which is the abasement of sex; and so to the main purpose of the book. Mr. Bishop Harman knows his subject thoroughly, and speaks his mind in good, stalwart English, which all can understand. He gives a clear story of the work of the Royal Commission on Venereal Diseases, with illustrations drawn from his own experience in London blind schools of the toll levied by these diseases upon the eyes of innocent children. He takes a wide view of future reform, believing that the true remedy lies in the cleansing and simplification of life, the better training of the young, and the encouragement of early marriage. In conclusion, he utters a word of warning against the danger that the fastidious apathy of the past may give place to an even worse folly—the folly of exaggeration.

A very complete *System for Case Taking*[3] suitable for medical cases has been compiled by Drs. ROSS and LOUDON for use in the Faculty of Medicine at the University of Toronto. It covers the ground satisfactorily, and, if the clinical clerks for whom it is intended carried it out properly, they would acquire a great deal of the knowledge they are striving to obtain. But, like so many schemes for the benefit of learners, it has the fault of being too good, too complete, too thorough, with the result that it is barely practicable, although it may hold up a worthy ideal to the student. To strike the happy medium in the fullness of the clinical notes taken is an art that can only be acquired after years of study. The system, if rigidly applied, would burden the notes with a great deal of irrelevant information in most cases.

[2] *Staying the Plague.* By N. Bishop Harman, M.A., M.B Cantab., F.R C S.Eng. Methuen's Health Series. London: Methuen and Co., Limited. 1917. (Cr. 8vo, pp. 128. 1s. net.)

[3] *A System for Case Taking, with Explanatory Notes.* By G. W. Ross, M.A., M.B.Tor., M.R.C.P.Lond., and J. Loudon, B.A., M.A.Tor., M.R.C.S.Eng., L.R.C.P.Lond. Toronto: The Macmillan Company of Canada, Ltd. 1916. (Cr. 8vo, pp. 69. 2s. net.)

PHYSICAL WELFARE OF MOTHERS AND CHILDREN.

REPORTS TO THE CARNEGIE UNITED KINGDOM TRUST.

ENGLAND AND WALES.

THE blue books giving the reports of the medical officers of the Local Government Board and the medical officer of the Board of Education for the past several years have been filled with information as to the work now being undertaken for the care of mothers and infants, and the reports of the medical officers of health for the several local authorities of the country have given particulars of the work undertaken in these districts, but hitherto there has been no comprehensive account of this many-sided work. The reports of the Carnegie United Kingdom Trust on the "Physical welfare of mothers and children"[1] fill this need in a most conspicuous fashion, and the two magnificent volumes issued will prove of the greatest service to all those engaged in this most essential work of national importance.

The reports aim at assisting in the solution of the various difficult problems involved by setting out the facts in relation to one another, and by placing on record the views of accepted medical authorities on the subject. In a prefatory note Sir Arthur Newsholme states that the number of mothers who died in England and Wales week by week as the result of pregnancy and parturition

[1] Report on the Physical Welfare of Mothers and Children (England and Wales). Vol. I, by E. W. Hope, M.D., M O.H. Liverpool; Vol. II, by Janet M. Campbell, M.D., one of the Senior Medical Officers, Board of Education; Vol. IV, by Dr. E. Cecy Bigger, Medical Commissioner for the Local Government Board for Ireland. Carnegie United Kingdom Trust. East Port, Dunfermline.

is on the average sixty-seven, of which number twenty-four are due to puerperal infections.

Dr. Hope's Report.

Volume I, written by Dr. Hope, is divided into three parts. The first contains general observations on ante-natal and post-natal care, and indications of what can be suggested as an ideal plan for the relations of the various parts of such schemes to the general administration of preventive medicine in an area. The second part gives a good summary of the existing legislative enactments which enable sanitary authorities to take action, and includes suggestions as to the directions in which such legislation might advantageously be strengthened. Lastly, there are a number of reports from medical officers of local authorities, all set out on the same plan, so that the various activities of the several authorities, the conditions of maternal and child life in the area, and the results of measures now in operation may be compared. Also, there are specific statements from the officers indicating their experience of the manner in which the work may best be improved. These statements are of great interest, and it is to be regretted that the like reports are not available for each and every area in the country.

The widening recognition of the supreme importance of maternal and child welfare has received additional stimulus from the unprecedented circumstances of the war; the steady decline of the birth-rate still further enhances the value of the infant, and is an additional incentive to guard and preserve it. A simple calculation shows that had the annual wastage of male infant life during the last fifty years been no greater than it is at present, at least 500,000 more men would have been available for the defence of the country to-day. Even now, 90,000 of the infants born each year in England and Wales fail to survive the first twelve months of life, and at each one of the succeeding four years of age a large, though rapidly diminishing, proportion succumbs.

We have heard a good deal lately about the saving of child life attendant on the smaller birth-rate, and that fewer births mean more and better children in the end. The report before us does not support this generalization. Statistics show that the number of infants surviving at the age of one year per 100,000 of the population is higher, both actually and relatively, when the birth-rates and infant mortality-rates are both high, than when the figures are low; in other words, under existing conditions it is the high birth-rate, notwithstanding its accompanying waste, rather than the low birth-rate and the greater saving associated with it, which dominates the increase of population. Comparing the Welsh urban districts, which have a birth-rate of 29.1 per 1,000, with the English southern rural districts, which have a birth-rate of 18.8 per 1,000, it is found that the number of survivors at the age of 5 years in the Welsh urban districts is 707 per 100,000 of the population greater than in the southern districts, although the infant death-rate of the Welsh districts is 113, as compared with 66 in the southern districts.

Dr. Janet M. Campbell's Report.

Volume II, by Dr. Janet M. Campbell, is also divided into three parts. The first is an admirable and most interesting account of the development of English midwifery from the earliest to the present time, in which our practice is compared with that of other countries. There are suggestions for the raising of the standard of midwifery in the country, and particularly for the needed provision in rural areas. Part 2 deals with schools for mothers, the feeding of expectant mothers, day nurseries, and nursery schools; Part 3 with play centres for children and playgrounds.

It should be added that not only is the matter of these two volumes of the greatest interest to the social worker, but they are written in such a fashion that they are eminently readable, and contain most attractive illustrations.

IRELAND.

Volume IV, by E. Coey Bigger, M.D., Medical Commissioner for the Local Government Board for Ireland, is a very human document, and Dr. Bigger is to be congratulated on his work. It contains much more than the ordinary collections of statistics. It is full of interesting comments on the lives of Irish people, and in many parts throws sidelights which go far to explain differences between the Irish and English mentality. Indeed, it is evident that the author loves human nature better than figures; figures he gives, but, so far as possible, they are kept to a place by themselves in the appendix.

Hitherto little special work has been done in Ireland for the benefit of mother and child. So far, Dr. Bigger writes,

> Ireland has relied too much on her natural advantages, and has done little beyond what her medical and nursing services have effected.

Those natural advantages rest in the peculiar temperament of the Irish woman.

> The Irish mother is celebrated throughout the world for the affection she has for her offspring. It is only amongst the most drunken and debased in the towns that there is any wilful neglect of or cruelty to children. But affection, unfortunately, is not sufficient. Love teaches much, but it does not teach all that it behoves a mother to know in cities and towns to-day. The truth is that, although she loves her child, she is not fitted for motherhood. The fault is not hers, but is that of the system of education in the country. All that she knows about her functions, childbearing, and child nurture is what she has learned from her mother; it has been handed down from generation to generation, and is a blend of good and bad, a mingling of useful knowledge and harmful tradition. . . . She knows, however, just one thing, and that, perhaps, is the most valuable of all, that she was intended to suckle her children herself, and, doing this, she saves her children from many dangers surrounding the use of the bottle. The practice of breast feeding is almost universal among the poorer mothers in the country, and is still very common in town.

Dr. Prudence E. Gaffkin, who contributes a section of the report, adds a further comment on the psychology of the Irish mother, which is not so greatly to her credit. Dr. Gaffkin writes:

> Their devotion to the newborn and helpless infant is remarkable. Nevertheless, I have not found them such devoted or such careful mothers once extreme infancy is passed, and in dealing with the child they are guided merely by instinct and inherited tradition. In many parts of Ireland families are very large, and yet the coming of another baby is not resented. If a woman bears eighteen or twenty children and twelve of them die from sheer inanition—well, life here is but a prelude to the world to come, and if the prelude for the baby is short and sharp it has at least gained the boon of everlasting life. Neo-Malthusian and even eugenic doctrines are considered wrong, and the breaking of the sixth commandment by bringing life into the world *only* to die has not yet been brought home either to man or woman.

Late marriage is reported as a cause of reduction of childbirth in some parts of Ireland. Women go to America to earn a dowry, marry late, and have few children. An even more curious custom is reported:

> It is generally the custom in most rural districts in Ireland for the eldest son, when he marries, to bring his wife to his father's farm, of which she becomes mistress, displacing the mother. But he cannot bring his wife till all his sisters are settled, and that is impossible without a dowry for them. All the savings of the household go towards these dowries, and it follows that as the sisters become older their dowry grows larger, and consequently their chances of marriage are increased. . . . Frequently a man must "marry off" a sister fifteen years younger than himself before he can think of matrimony. The medical officer of a western district states that the most common age for the marriage of men in his district is 40 to 50, and gives his opinion that the late marriage at a time when the parties have lost much of that vitality of youth on which racial strength depends, is a cause of lack of vitality in the children which has its effect on both their mental and physical natures, and which in his opinion is tending towards a serious racial degeneration.

Dr. Bigger makes some specific recommendations to which we hope to refer on some future occasion.

THE forty-sixth annual report of the State Board of Health of Massachusetts, a board that has now become a department, contains a full and interesting account of the multifarious activities of that body during the year 1914. Most of the volume deals with problems and work done in connexion with the water supply and sewerage, but many pages are devoted to the work of the inspectors of food, drugs, cold storage, slaughterhouses, and dairies.

British Medical Journal.

SATURDAY, JUNE 2ND, 1917.

BRITISH SURGERY AT THE FRONT.

A FEW weeks ago we published a group of papers giving an account of the response of British medicine, as represented by the Royal Naval Medical Service, to the new phases of clinical, pathological, and administrative medical practice which have arisen during the war at sea. This conspectus of medicine, surgery, hygiene, and sick transport in the navy under war conditions gave some idea of the admirable work carried out during years of preparation and perfected under the test of active service. In our present issue we publish a set of articles illustrating the progress of surgery during the land campaign on the Western front, from the pens of consultants and specialists serving with the British armies in France who have identified themselves with the subjects of which they treat.

Surgeon-General Sir Anthony Bowlby and Colonel Cuthbert Wallace, in their summary of the present position, record the leading facts which experience has established and describe the trend of surgical opinion and practice, more particularly in the treatment of abdominal wounds, head injuries, wounds of blood vessels, fractures, and joint injuries. They point out the indispensability of the motor ambulance, around which one might safely say the whole surgical system from front to base has been organized. Motor transport of the wounded and the casualty clearing station together form the keystones of the system, and the saving of lives, limbs, and suffering due to their development since the early months of the war has been immense.

In the JOURNAL of December 4th, 1915, we gave a sketch of the evolution of the casualty clearing station, which even then had firmly taken its place as the pivot surgical unit between the collecting and evacuating areas. Situated near the distal end of a line of communication, this unit is in essence an advanced base hospital, equipped and staffed for the immediate operative treatment of bad cases, while still performing the functions associated with its name. An important point made by Sir Anthony Bowlby and Colonel Wallace is that surgery at the front is a special branch of practice which all have to learn by direct experience, and a sound opinion on wound treatment comes to no one, however gifted, by the light of Nature. This seems to be specially true of the decision when and where to amputate. Among other things the war has abolished the old formal amputation dear to the teachers of operative surgery and examiners of former days. Another development in technique has been the early routine excision of damaged tissue, and the use of moist dressings containing such antiseptics as eusol, Dakin's solution or its outcome chloramine-T, which have been devised to meet the special conditions of wound infection at the front.

In abdominal surgery progress was at first hindered by the school of thought which held to the expectant line of treatment. After a few months it was demonstrated beyond doubt that under the conditions of this war early evacuation from the front line and immediate operation gave the only hope of success. For some time past the rule has been to operate, unless there is some special reason to the contrary; not to await special indications but to open the abdomen and make a rapid, methodical examination of the intestine, suturing rents in the gut, and resecting only where this is inevitable. The modern practice—aided by a special service of cars for hurrying abdominal cases to the clearing station or small advanced operating centre—has resulted in a lowering of the death-rate estimated at between 15 and 20 per cent., although the mortality from these wounds is still distressingly high.

In the surgery of joints gratifying improvement has followed modern lines of treatment. In head surgery effort has been directed towards devising the best operation and standardizing a general line of treatment adaptable to all varieties of cranial wounds. It was found that head cases travel badly after operation, although, provided the pulse is slow, they travel well as a rule between injury and operation. Early operation and prolonged rest after it is, therefore, the ideal, and this has been attained to some extent, as we learn, by the establishment of special hospitals neither too near nor too far from the line. With regard to fractures of the limbs the most important generalization seems to be that no amount of skilled after-care can make up for improper early treatment. Thorough deliberate operation is needed, and, as would be expected, the operating facilities of clearing stations, combined with the *x*-ray plants which have sprung up in connexion with them, have brought about great improvement, while the almost universal use of the Thomas splint and its progeny is an important factor.

In this article are brought to a focus also the latest views on the causation and treatment of gas gangrene, the dreadful infection which has proved one of the greatest horrors of the present war. Colonel Wallace, in a further contribution to our knowledge of this subject, describes—with coloured illustrations made from drawings by Mr. A. K. Maxwell, the artist employed by the Department for the Medical History of the War—the naked-eye changes in skin and muscle produced by gas gangrene; Captain McNee and Captain Shaw Dunn furnish a report on their researches into its mode of spread within muscular tissue; and Lieutenant-Colonel Frankau, Captain Drummond, and Captain Neligan, in their article on conservative treatment, emphasize the importance of arresting infection in muscle by early resection of the infecting focus. Sir Wilmot Herringham gives an interesting account of thoracic wounds. Unlike those of other regions referred to, chest wounds have generally done better under expectant treatment, actual sepsis alone calling for surgical intervention. Penetrating wounds of the chest have thus remained, to some extent, the province of the physician. Captain Marshall describes the administration of anaesthetics at the front. It will be noted that he is a strong advocate of warmed ether, and of gas and oxygen, and is convinced that not even the most urgent operation should be done while the patient is in a state of shock; the combined shock of anaesthesia and operation superimposed on the shock of the wound and the journey is too much for the patient.

Looking at the articles as a whole, and reviewing the large number which have already appeared, the thought which comes uppermost in the mind is one of admiration for the adaptability, ingenuity, and perseverance of the British surgeon in face of difficulties undreamt of in any previous campaign. As the story unfolds itself one sees in epitome the resourceful spirit of our race. A great and smooth-running organization

has been built up during the war for the treatment and disposal of the wounded and sick. For the success which has been achieved the Army Medical Department deserves the highest praise, and not least for the use it has made of the consultants since the early months of the war. These civilian surgeons and physicians passing from unit to unit, guiding and encouraging scattered workers, watching experimental lines of treatment and collating results, formulating rules and principles, and discussing with administrative officers the practical application of the lessons of experience, have played a great part in the development of military medicine and surgery.

DYSENTERY AT GALLIPOLI.

THE acute dysentery of war has generally been regarded as in the main bacillary, and this was certainly true in the South African war (1899–1902), though in the Spanish-American war the American troops in Manilla, where amoebic dysentery is endemic, suffered from both forms, and, as Strong proved, mixed infections occurred. When cases of dysentery contracted in Gallipoli by the Mediterranean Expeditionary Force began to arrive in this country during the autumn of 1915 difficulty in deciding as to their nature, and therefore on the appropriate treatment, arose. For whereas at the front, and especially in the base hospitals at Alexandria and Cairo where amoebic dysentery is common, the prevailing opinion was in favour of the amoebic origin, in this country evidence in support of this view was commonly wanting. This divergence of opinion may reasonably be explained, at least in part, by the convalescent state of the patients, who had nearly all received routine treatment by emetine before their arrival here. Subsequently the question was apparently settled by the compromise that both forms occurred, that each was predominant at different periods, and that mixed infections were frequent.

Among the valuable reports now being made on the subject of dysentery to the Medical Research Committee special interest attaches to that of Dr. Bartlett "On dysentery in the Mediterranean Expeditionary Force,"[1] based on the experience of some eight months' work as pathologist to No. 21 General Hospital in Egypt, where he examined 1,129 stools and observed 61 necropsies on cases of dysenteric ulceration, the microscopic examination of the material being completed at the London Hospital. This careful and elaborate research, illustrated by thirty-four figures and summarized in thirty conclusions, confirms the opinion that the dysentery was primarily amoebic. Secondary bacterial infection, however, was very frequent, and in some cases so intense as to obscure the amoebic lesions by a diphtheroid inflammation resembling that of bacillary dysentery. Out of the 61 necropsies, 56 (92 per cent.) showed amoebic lesions, and out of the 5 remaining cases, tentatively called pure bacillary dysentery, evidence of a specific infection by organisms of the dysenteric group was forthcoming in one only. Examination of 477 dysenteric stools showed that 379 (79.4 per cent.) contained vegetative amoebae of pathogenic type. From these results it is obvious that specific treatment should be adopted as soon as possible so as to arrest amoebic ulceration before the colon has become more vulnerable to bacterial invasion. Thus Sir Ronald Ross's advice in August, 1915, that emetine should be given early to all cases of dysentery was fully justified, and was considered to have prevented a much higher mortality among the forces. But as secondary bacterial invasion may prove fatal from purulent diarrhoea after amoebiasis has been removed by emetine, measures to combat it are necessary, and for this purpose saline purgatives to flush out the colon and bismuth mixture by the mouth were employed. A powerful multivalent anti-dysenteric serum, prepared at Alexandria, was also used in such cases, but opinions as to its value varied widely.

The cases referred to by Dr. Bartlett received injections of emetine hydrochloride ½ grain until 6 or 10 grains had been given, and after an interval one or two further short courses. Usually this was successful, but it is frankly admitted that in some instances a thorough course of treatment failed to eliminate amoebiasis. The high reputation of emetine injections in *Entamoeba histolytica* carriers has been gravely impugned by Mr. Clifford Dobell,[2] who states that full courses (10 to 12 grains or more) are successful in about one-third only of the cases treated, and that subsequent courses offer little hope of cure. He advocates the oral administration of emetine bismuth iodide in daily doses of 3 to 4 grains until 36 to 40 grains have been given. By this means the vast majority (90 per cent.) of carriers are cured even when emetine injections have previously failed. Dr. G. C. Low,[3] in a further report to the Medical Research Committee, mentions that vomiting caused by the administration of emetine bismuth iodide can be eliminated or reduced to trivial proportions by giving the double iodide in pills coated with salol, as recommended by Dr. H. H. Dale.

[1] G. B. Bartlett, *Quart. Journ. Med.*, Oxford, 1917, x, 185-244.

MEDICAL MEN IN PUBLIC LIFE.

THE failure of members of the medical profession to take their fair share in the work of public authorities throughout the country has been the subject of standing criticism both within and without the profession for many years—since, at any rate, the remarkable address on the political powerlessness of the profession given in 1883 by Sir Walter Foster (afterwards Lord Ilkeston). Many reasons are given for the fact, which can hardly be disputed, although a considerable number of medical men serve on the councils of boroughs and county boroughs. There are however, we believe, very few medical members on county councils, and we are glad to know that their number has been increased by the election of Dr. W. W. Robb to be the representative of the Irthlingborough Division on the Northampton County Council. Dr. Robb had been M.O.H. for the Irthlingborough Urban District for fourteen years, until his resignation at the end of 1915, and he is a J.P. for the county. It is, we are told, many years since the medical profession was represented on the Northampton County Council, and Dr. Robb is now the only medical member of it. Many reasons are given for the disinclination which medical men apparently feel in seeking to become members of local councils; one is the difficulty a man in busy practice finds in giving the amount of time which membership of a county council entails, and another is the dislike of entering upon a contested election. But county councils themselves have the power to obtain the services of medical members by nominating them to be aldermen, as has been done in certain cases. However

[2] Medical Research Committee. Reports upon Investigations in the United Kingdom of Dysentery Cases received from the Eastern Mediterranean. 1. Amoebic Dysentery and the Protozoological Investigation of Cases and Carriers, pp. 69–83, 1916. BRITISH MEDICAL JOURNAL, January 27th, 1917, p. 127, and March 24th, 1917, p. 400. See also Mr. Dobell's paper, BRITISH MEDICAL JOURNAL, November 4th, 1916, p. 612.

[3] *Lancet*, 1917, i, 483.

this may be, we are quite clear that it would be to the advantage of the profession and the public itself if county councils had more medical members.

FRAGILITAS OSSIUM, BLUE SCLEROTICS, AND OTOSCLEROSIS.

IN an interesting paper, published in the *Edinburgh Medical Journal* (April, 1917), Dr. E. Bronson gave a very clear picture of two families in which a rare abnormality, consisting in what he terms fragilitas ossium, was associated with other abnormalities. In addition to the two families, which illustrate its hereditary characteristics, he has mentioned a few cases in which no such hereditary influence was discoverable. The outstanding feature in each case was the extreme degree of brittleness of the bones, so that numerous fractures occurred without violence; there was also hypotonicity of the joints. The associated peculiarities are a blue sclerotic, progressive deafness, shortness of stature, and bulging of the frontal and occipital regions of the skull. The earliest record of association of the blue sclerotic with fragility of the bones was made by Eddowes in 1900. In one family it was noted that the depth of colour of the sclerotic corresponded to the degree of fragility of the bones. In other instances blue sclerotics were observed apart from this association. Fractures occurred in children whose parents had not had fractures, but had hypotonicity of the joints (one case) or blue sclerotics (one case). The earlier in life the fractures commenced the greater the subsequent liability; this was specially marked in the pre-natal cases. The fractures generally occurred without causing pain at the time; there was rapid reunion, sometimes without formation of callus. Shortness of stature was the more marked the earlier the onset of signs of the defect. The general health of the adults was good. Radiography showed that the bones were frequently much reduced in thickness, especially in the shafts, and there was rarefaction; considerable deformity often resulted from the numerous fractures. Chemical and histological examination of the sporadic cases failed to throw much light on the etiology of the condition, but in several cases there was no true lamellar formation; the Haversian canals were absent, the osteoblasts were abnormal in structure—and presumably in function also—and the cells of the articular cartilage underwent direct calcification. No histological examination of the hereditary cases has been made. As regards treatment, several plans were tried, but without benefit. On theoretical grounds no benefit would be anticipated from any drug or hormone, for probably the condition is primarily due to the presence of some substance ("factor") interfering with normal metabolism. The defect is inherited as a Mendelian dominant, and a dominant, according to present theory (and high probability), is due to the presence of the controlling factor. It is difficult to see how drugs could rid the system of something inherited from the parent. The paper concludes with a very full bibliography. The author makes a mistake in discussing the etiology when he says, "The inheritance, when present, is direct transmission—*what Bateson calls 'knight's move'*—namely, the characteristic fragility is a dominant one." It is true that the inheritance is direct, and that the abnormality behaves as a Mendelian dominant; but it is not inherited like a knight's move. His statement would be correct if the words placed in italics were omitted. Colour blindness and haemophilia both show the so-called knight's move, which means that an affected male transmits his defect to a male grandchild through a daughter who does not show the defect—that is, a generation is skipped; but in the family described by Dr. Bronson there is no such skipping.

INTRACRANIAL ANEURYSM.

THOUGH the presence of an aneurysm on one of the basal cerebral arteries has rarely been diagnosed correctly during life, yet the discovery of such an aneurysm at autopsy is far from uncommon, and these cases have for long attracted the attention of clinicians and pathologists alike. A full account of the subject, together with records and an analysis of forty-four new instances, has recently been published by Dr. E. G. Fearnsides.[1] Speaking generally, these aneurysms have been attributed in the past to arterial syphilis, to arterial degeneration, whether local only or generalized, to congenital defect of the arterial wall, or, fourthly, to the local action of infective emboli, in varying proportions of the cases recorded by various authors. Dr. Fearnsides, adopting Turnbull's classification[2] of arterial diseases, notes that in none of his new cases of intracranial aneurysm was syphilitic infection the cause of the vascular disease, although such instances are not rare in the literature, particularly in the case of the relatively large basilar artery. His new pathological material is based on the records of the Pathological Institute of the London Hospital. Here, during the years 1907 to 1913, nearly eight thousand *post-mortem* examinations were made, in 5,432 of which the cranial contents were investigated. Among these, 184 true and 7 dissecting aneurysms of the aorta were found, 175 of them due to syphilitic inflammation; 43 true aneurysms of other large elastic arteries were discovered, all due to syphilitic inflammation; there were 44 examples of true aneurysm of muscular and small elastic arteries, excluding those of the brain, only 6 of which were syphilitic in origin; and, finally, there were 51 true aneurysms of cerebral arteries, 15 due to infective embolism and 36 caused by medial degeneration, occurring respectively in 13 patients with ages between 5 and 44 and 31 patients aged from 19 to 86. In 35 of these 44 persons death had been caused by rupture of a cerebral aneurysm; 26 were males, 18 females. Discussing the clinical manifestations associated with intracranial aneurysms of non-embolic origin, Dr. Fearnsides remarks that in only one of his thirty-one patients did an unruptured aneurysm at the time of its development appear to have caused acute intracranial symptoms, although a shrewd guess as to the causative factor was made before autopsy in a considerable proportion of them. Details and discussions of many of the 44 cases are given, and it appears that of the 13 instances of aneurysms on the cerebral arteries due to infective embolism, 10 were associated with progressive ulcerative endocarditis; in 2 patients it was the onset of nervous manifestations that brought them to the hospital. Numerous interesting points emerge from the clinical study of the 31 new examples of non-inflammatory cerebral aneurysm. In 15 of them the heart was not hypertrophied. In 25 of them clinical manifestations pointing to cerebral haemorrhage occurred, in 5 an unsuspected and unruptured aneurysm was found, and in one an unruptured aneurysm was discovered at the junction of the right carotid and middle cerebral arteries in a patient who for some time had suffered from right frontal headache and had been deaf in his right ear. Multiple leakages of blood due to partial ruptures of the aneurysmal sac occurred in 13 instances, together with a history of multiple seizures of an apoplectic type. The first rupture of the sac of a cerebral aneurysm was often brought about by a violent muscular effort or emotion; signs of increased intracranial pressure were rare before rupture, but frequent after it had taken place, 10 patients before death showing changes in the fundus. In many instances the cranial nerves, particularly the third pair, were involved in blood-clot after the rupture. After rupture of aneurysms of the posterior fossa a complaint of stiffness in the neck is said by Dr. Fearnsides to be a sign valuable in diagnosis; an involvement of the facial nerve after its exit from the pons is also common. It may be added that the finding of blood cells and blood pigment in the cerebro-spinal fluid obtained by lumbar puncture is the

[1] *Brain*, London, 1916, xxxix. 224-296.
[2] *Quart. Journ. Medicine*, Oxford, 1915, viii. 201.

only clinical evidence of cerebral haemorrhage that can be obtained; in the case of ruptured intracranial aneurysms staining of the cerebro-spinal fluid occurs early. The localizing signs in cases of embolic intracranial aneurysms are usually scanty; but the headaches associated with those of non embolic origin may have some localizing value.

TUBERCULOSIS IN THE UNITED STATES ARMY.

A LARGE general hospital at Fort Bayard, New Mexico, is devoted to the treatment of tuberculosis in soldiers of the United States Army, a limited number of civilians of both sexes being also received. A report is issued every year, presenting the results of the year's working and an analysis of so-called completed cases. The completion, however, only relates to results as far as the hospital is concerned, and no evidence is afforded as to the ultimate success or failure, as shown by capacity for work on return to military duty. The proportion of men so returned during the year 1915 is not very high, and this fact may be accounted for by the large numbers admitted in the later stages of disease. Although the mortality does not exceed the average for chest hospitals in general, the number of patients who are only to be classed as "improved" by treatment goes to prove that treatment has been too long deferred. The frequent occurrence of tuberculous laryngitis as a complication points in the same direction. The climatic advantages of the south western portion of the State of New Mexico would seem to offer ideal conditions for arrest of incipient disease by open-air methods, but only a small proportion of the total admissions to the hospital appear to have been in the early stage. The experience of all chest hospitals has shown that a certain amount of improvement may be expected even in town hospitals. Where improvement only can be hoped for it would seem to be a misuse of advantages to utilize sanatoriums in the most favourable climatic conditions for any but incipient cases, capable of permanent recovery. Details are given in the report of a very large number of individual cases, and it may be noted that only about 17 per cent. of the whole presented febrile conditions, or a maximum temperature of 100° or more. In an unusually large proportion also it is recorded that there was no impairment of digestion. The percentage of general success as regards actual arrest of disease would doubtless be far higher if the admissions were restricted to cases in the incipient stage.

A NEW PHYSICIAN-POET.

AMERICA has not so far produced a great number of doctor poets, but in point of quality she has no reason to fear comparison with the Old World. The names of Oliver Wendell Holmes and Weir Mitchell are a host in themselves. To these must now be added another of equal brilliancy. Quite recently a new medico-poetic planet has swum into the ken of lovers of literature in the person of Dr. Frederick Peterson, of New York, whose name is well known to the profession by his work in neurology and morbid psychology and his pioneer efforts to promote the treatment of cases of incipient insanity in psychopathic hospitals. He contributed an article on the hospital treatment of insanity to the tenth edition of the *Encyclopaedia Britannica*. He was for many years professor of psychiatry in Columbia University, and he is the author of a work on nervous and mental disease, written in conjunction with Dr. Church, of the *American Textbook of Legal Medicine*, produced in collaboration with Professor Haines, and of many contributions on subjects within his special province to medical periodicals, notably to the *New York Medical Journal*, of which he was assistant editor for several years. It is in the issue of that journal for March 31st that the announcement of Dr. Peterson's appearance in his new avatar as a poet is made. He had, it is true, published a volume of verse and translations from the Swedish as far back as 1883. But he has now spread his wings in a greater flight. During the past two years, as we learn from our New York contemporary, many lyrics dealing with natural phenomena and landscapes in their relation to mankind, favourite themes with Chinese artists, have appeared in American literary magazines under the signature "Pai Tu-Shan." These have been collected in a volume printed in luxurious style by Kelly and Walsh of Shanghai (New York: Scribner and Sons), illustrated with collotype reproductions of ancient Chinese paintings, and bound in Chinese silk. The examples given in the *New York Medical Journal* seem to show that Dr. Peterson has rendered in graceful verse the dainty touch of the Chinese artist.

THE PSYCHOPATHIC LABORATORY.

THE city of Chicago has a population of over two and a half million souls. Its Municipal Law Court has an ever-increasing amount of business to deal with, and every year sees more and more civil cases—misdemeanour, felony, and criminal cases—filed in its books. In 1908 the number of offences for which persons were arrested was over 75,000; in 1915 this number had grown to 137,000. A recent volume [1] of the *Annual Reports* of the Municipal Court of Chicago gives some account of the legal machinery that has been developed for dealing with this mass of ill-doing. Many pages of the *Reports* are occupied by an account of a new piece of mechanism for making the punishment fit the crime in the cases of juvenile depravity and chronic offenders. This mechanism is described as the Psychopathic Laboratory. It has long been recognized that there is in many instances a close connexion between mental and physical defectiveness on the one hand and criminal conduct on the other, these terms being used in their widest senses. In other words, very many offenders break the law and come to bar in consequence of mental defect or disease. It is the business of the Psychopathic Laboratory to investigate the physical and mental development of offenders in all instances in which the evidence or the prisoner's behaviour in court give rise to suspicions of his soundness in either mind or body. The Laboratory employs a great variety of tests, and relies upon no single method of examination. It is found that the ordinary physical examination frequently yields convincing results, and that the reactions to neurological tests explain other cases of delinquency. The tests of psychiatry often disclose latent dementia of various kinds. The purely psychological tests—many of them of the Binet-Simon type—reveal instances of feeble-mindedness in varying degrees. Reliance is not placed on these laboratory examinations alone. With the offender comes a history of the case, throwing light on the environment and characteristics of the delinquent. Confirmation of the conclusions already reached is often furnished by a study of his heredity. Great emphasis is laid upon the importance of reaching a correct diagnosis for the following reason. The offender who is normal in mind and body reacts to punishment in such a way as to justify the view that punishment is an effective deterrent. Not so, however, the defective. The victim of imperfect mental equipment, the slave of narcotic habit, the child or adult with serious organic disease of one sort or another—these all require special treatment. The institutions and methods which have been evolved all the world over for the discouragement of crime practically all predicate mental competence and responsibility in their subjects. This fact explains the frequent failure of correctional and institutional treatment to prevent relapse into crime, and accounts for the existence, in the State of Illinois, of an offender who has been sentenced two hundred times, to quote a glaring example. What is to be done with the defective delinquents once they have been identified and labelled in the Psychopathic Laboratory? Punishment is useless. Those who are feeble-minded can get along very well outside institutions if they are placed and kept in a simple

[1] Eighth and Ninth Annual Reports of the Municipal Court of Chicago, December 1st, 1913, to December 5th, 1915, inclusive. Chicago: Cameron, Amberg and Co.

but protected environment. No fewer than two hundred instances of dementia praecox were detected among 2,700 delinquents investigated in the Chicago Laboratory; these are more dangerous cases, and it is suggested that they should be confined in farm colonies under proper supervision. One of these delinquents—a case of high-grade mental defectiveness combined with dementia praecox—had been in court on thirty-seven previous occasions. It is thought that such defective delinquents as these might be employed in road-making and other public work of the kind. The *Reports* give a full account of the many-sided work put upon the psychopathic expert who is placed in charge of such a laboratory as that described. He must be an expert in surgery, medicine, venereal disease, obstetrics, neurology, psychology, and psychiatry; but where such accomplished paragons as this are to be found is not indicated. It is clear that the Psychopathic Laboratory is based upon the most scientific and logical foundations, and that it should, in theory at any rate, be of the greatest service to judges and justices called on to pronounce sentence on criminals and offenders of the relapsing or mentally defective types. How far the bench would feel inclined to put itself at the disposal of the laboratory and take its orders, and how far the astute criminal might succeed in imposing on the psychopathic expert, are questions that only practical experience can settle.

RHUBARB AND RED TAPE.

OUR contemporary, *Nature*, published on May 24th an interesting and timely article on rhubarb, intended by its author for the *Kew Bulletin*, the publication of which the Government in its wisdom has decided to suspend. The official explanation given for this paltry piece of economy is "that it has been ruled that the *Kew Bulletin* is not essential, and its publication has therefore been suspended" owing to the shortage of paper. The small amount of paper needed to secure the continued publication of so useful a periodical, which serves as a link between scientific and economic botany, could well be spared by a trifling reduction in the waste of paper in a single Government department. Lop-sided actions of this sort bring our Government into contempt, and indicate a narrowness of outlook threatening the future of the country. With these remarks we pass to the smaller topic of rhubarb. The article in *Nature* traces the history of *Rheum rhaponticum* as an article of diet. The author's researches bring to light the fact that poisoning by rhubarb leaves, of which several cases have been reported lately, is no new thing. Seventy years ago the case was recorded of a Chelsea woman who boiled rhubarb leaves as a substitute for spinach, and all three of those who ate of the dish were attacked with sickness; the *Gardener's Chronicle* of the day recommended the subject to serious chemical inquiry, deeming it quite conceivable that the leaves contained some principle which the stalks lacked, and warned the public against employing for food any part of the rhubarb except that shown by experience to be wholesome. It was suggested at that time that the chemical composition of rhubarb varied to some extent according to the variety, and also according to the soil on which it was grown. Solly, in the *Transactions of the Horticultural Society*, 1848, showed, as the result of experiments, that considerably less water was present in the leaves than in the stalks, but nearly twice the amount of organic and inorganic matter. It would therefore not be surprising if salts of oxalic acid were present in greater abundance in the leaf blade than in the leaf stalk. At the resumed inquest held this week on the Enfield clergyman who died after eating cooked rhubarb leaves, the assistant analyst to the Home Office stated as the result of analysis that oxalic acid in the form of potassium and calcium salts was present in the proportion of 10 grains of each to the pound. Dr. Spilsbury from chemical analysis of the organs stated that death was due to poisoning by oxalic acid and soluble oxalates, and went on to say that 20 grains to the pound in the ordinary way would not be sufficient to cause death, but such an amount was on the border line, and while it would affect some people, others would escape. He considered the use of rhubarb leaves as a vegetable inadvisable, but agreed with the coroner that there was no harm in the stalk provided soda was not used in the process of cooking. For more than 100 years the stalks of rhubarb have been used on an enormous scale in this country as a substitute for fruit, and except in rare cases of idiosyncrasy this part of the plant appears to be a harmless dish. It is quite clear, however, that the leaves should not be eaten.

SPECIALIZATION IN MILITARY MEDICINE.

SPECIALIZATION in applied science is one of the characteristics of the day, and we have seen its rapid development in medicine during the last two generations. It is not surprising, therefore, that it has been found advisable to apply the principle to military surgery and medicine. Thus the British military medical authorities have found it proper to establish special hospitals or centres for the treatment of disorders of the heart, skin diseases, venereal diseases, for severe compound fractures of the thigh, and for the treatment of disabled men in orthopaedic hospitals and curative workshops. Professor Strauss, in a recent paper in the *Deutsche medizinische Wochenschrift*, suggests that special hospitals, or departments of hospitals, should be set apart for cases requiring special diets, such cases as those of gastric disorder and chronic dysentery. He also wishes to see special wards for men suffering from trench nephritis, and, indeed, asks for two sets of wards for war nephritis, one for severe and the other for light cases, to facilitate the satisfactory dietetic treatment of such patients.

Medical Notes in Parliament.

The Venereal Diseases Bill Passed into Law.—In the House of Lords, on May 25th, Lord Rhondda moved that the amendments to the Venereal Diseases Bill made in the Commons should be accepted. No further objection was offered, and the bill afterwards received the Royal Assent. The changes have already been stated in this column.

Medical Examinations.—In the Commons Mr. Needham asked what course was open to a man called up for military service under the new Act who was dissatisfied with his medical classification. Mr. Macpherson said an application to be examined by a special medical board was submitted for the consideration of the War Office by the military representative in a case in which such examination was recommended by a military service tribunal before which the man concerned had laid his case. Mr. Pringle: Are we to understand that he cannot get an appeal to a special medical board except through a tribunal? Mr. Macpherson: That is so. On May 25th Mr. Macpherson informed Mr. Hogge that a man to whom a notice under the Review of Exceptions Act was sent was deemed to be enlisted, and was transferred to the reserves as from the appointed date. The appointed date was the thirtieth day after the date of the notice. Any time before the appointed date a man had the right of appeal to a tribunal for exemption, and that right was independent of the date of the medical re-examination of the man. The application might be made whether or not the medical examination had already taken place. In reply to Mr. Theodore Taylor, Mr. Macpherson said that he was not aware, as suggested, that examination of recruits by medical boards had frequently been made at the rate of thirty per hour. Express instructions had been issued that examinations under the Review of Exceptions Act should be most careful. The classification certificate was signed by the president of the board.

The Medical Treatment of Naval Officers.—Mr. Mooney asked the Secretary to the Admiralty whether an officer or warrant officer sent to a hospital or to a sanatorium suffering from tuberculosis was allowed full pay during the period he was off duty; whether out of this allowance he had to meet all doctors' bills and expenses of treatment in a sanatorium or hospital; whether officers suffering from other diseases, no matter what the cause, were treated at the expense of the State; whether he was aware that this treatment of tuberculous disease caused hardship. Dr. Macnamara said the facts were generally as stated. Arrangements were, however, provided for the reception of all such cases, after invaliding, into sanatoriums at the public expense. It was recognized, nevertheless, that the treatment so given was not what should be supplied for officers, and steps were being taken to remedy this defect.

THE WAR.

THE ORGANIZATION OF THE AMERICAN BASE HOSPITAL UNITS.

The six medical units from the United States which are to take over base hospitals in France will, it is expected, all have arrived before the end of this week. The unit from the Western Reserve University, Cleveland, some particulars of which were given in the last issue, was followed quickly by units from Harvard (Boston) and Columbia (New York), both of which have already left London for the Continent, and these by units from St. Louis, Philadelphia, and Chicago. The Harvard unit, whose official title is United States Army Base Hospital No. 5, was organized under the American Red Cross by Professor Harvey Cushing. It consists, like the others, of three members of the administrative staff taken from the medical corps of the regular army—namely, Major Robert U. Patterson, commanding, Captain D. W. Harmon, adjutant, and Captain Charles Rund, quartermaster. The professional staff, in addition to Major Harvey Cushing, includes Major Robert I. Lee, professor of hygiene at Harvard, and Major Robert B. Osgood, professor of orthopaedics, together with five officers holding the rank of captain and sixteen that of first lieutenant. Among the latter is Dr. W. B. Cannon, professor of physiology at Harvard. The staff includes an anaesthetist, a radiologist, two dental surgeons, and other specialists, including a dietist. The hospital company consists of 16 orderlies from the medical department of the regular army and 132 specially enlisted men, 65 per cent. of whom are Harvard students. The nurses number 64, and there are three secretaries. All have "signed on" for the duration of the war.

The Columbia unit, whose official title is United States Army Base Hospital No. 2, is commanded by Major L. L. Hopwood, with Captain Edward Wells as adjutant, and Captain D. F. Hopkins as quartermaster. The director of the professional staff is Major George E. Brewer, professor of surgery at Columbia and surgeon-in-chief of the Presbyterian Hospital, New York City. The chief of the surgical service is Major William Darrach, and of the medical Major Homer Swift, and the number and assignments of the unit are virtually the same as in the case of Harvard and the others.

The fourth and fifth contingents to arrive were the Washington University unit (Base Hospital No. 21) from St. Louis, and the Pennsylvania Hospital unit (Base Hospital No. 10) from Philadelphia. The sixth and last contingent, from Chicago, was expected at the end of this week. In all these cases the organization is practically the same as in the Western Reserve, Harvard, and Columbia units already described, save that the St. Louis unit has a feature which, so far as our information goes, is peculiar to itself. Arrangements have been made for those of the enlisted men from St. Louis who are medical students to continue their studies while serving with the unit. There are thirteen of these at present, but the number is expected to reach thirty-five by next January. Washington University has recognized the professional staff as a teaching faculty, and has arranged to substitute the work with the unit for the fourth year in the medical school; the university teaching, both in medicine and surgery, will be carried out in France. This unit is commanded administratively by Major James D. Fife, with Captain Thomas C. Austin as adjutant and Captain G. S. Kopple as quartermaster. The director of the professional staff is Major F. T. Murphy, professor of surgery at Washington University, and the assistant directors are Major Walter Fischel, associate professor of medicine, and Major Malvern B. Clopton, associate professor of surgery. The assistant director of the laboratory service is Captain Eugene L. Opie, who is professor of physiology, and the staff includes Captain Allison, Captain Veeder, and Captain Sidney Schwarb, associate professors respectively of clinical orthopaedic surgery, pediatrics, and neurology. All the members of the professional staff are attached to the Barnes Hospital and the Children's Hospital, St. Louis, both of which are integral parts of Washington University. The commissioned officers number twenty-eight in all. The chief of the sixty-five nurses is a lady well known among the social workers and educationalists of America—namely, Miss J. C. Stimson, niece of a distinguished American surgeon. The enlisted staff embodies about 160 men.

The Pennsylvania unit is the only one of the six which is not attached to a university; its members are part of the staff of Pennsylvania Hospital in Philadelphia. Major De Laney is the commanding officer and Major Richard Harte the professional director. Like the Harvard and Washington units, this group includes a chaplain.

The unit from Pennsylvania Hospital, Philadelphia—the oldest hospital in the United States—is commanded by Major M. A. De Laney, with Captain N. L. McDiarmid as adjutant and Captain H. L. Kidwell as quartermaster, all of the medical corps of the United States army. The director is Major Richard H. Harte, surgeon to the Pennsylvania and Orthopaedic Hospitals, Philadelphia; with Major H. Gibbon as chief of the surgical service and Major George W. Norris as chief of the medical service. All the professional staff are graduates of the University of Pennsylvania, with the exception of Major Gibbon. The hospital company includes 156 men and 64 trained nurses.

Another unit of medical men to arrive this week consists of twenty orthopaedic surgeons, in charge of Major Joel E. Gouldthwaite. These surgeons are from various parts of the United States and have come over at the request of Colonel Robert Jones for work at present in the British Isles.

Major Brewer gave a representative of the British Medical Journal some details of the origin and standing of these units, and these were supplemented by Major Patterson, of the Harvard unit, who has been first assistant to Colonel Jefferson R. Kean, of the medical corps of the United States army, to whom the development of the organization of these base hospitals by the Red Cross is due. The idea was originated by Dr. George W. Crile, now the director of the Western Reserve unit, as a result of his experiences in the Spanish-American war, and was brought to fruition by Colonel Kean. The United States Government has no authority to organize military medical units in time of peace, but by a presidential proclamation in 1911 the Red Cross was authorized to act as a Government agent to prepare in advance certain hospital units composed of medical men and nurses and, as far as possible, of orderlies, laboratory assistants, and administrative staff, who had been working together in similar relative capacities in some large hospital. These were organized under the Red Cross, and each member signed a pledge to hold himself or herself in readiness to respond to any call by the Government on a declaration of hostilities. During hostilities, or when these are imminent, the units can be enlisted as regular military organizations under the sole control of the War Department, and each of the medical officers of the unit must be a member of the medical reserve corps. This arrangement was designed to make well-organized hospital units immediately available for service in the base hospitals in time of war, and to avoid the necessity of calling together men from different parts of the country who had had no previous association. Major Brewer stated that the units, most of which are organized from hospitals attached to university medical schools, now number thirty-eight, and during the past year each of these units has been supplied with a full hospital equipment, including beds, bedding, linen, instruments, hospital furniture, *x*-ray and laboratory apparatus, and a supply of surgical appliances and dressings enough to last for two months' active service. When these units are called out the War Department furnishes three officers from the regular army to take charge of the administration of each of them, while the professional personnel remains under the director who has been at the head of the unit from the first, and with him are two subdirectors, one to superintend the surgical, and the other the medical, service. The staff includes a chief of laboratory service, a competent pathologist, a bacteriologist, and a number of laboratory technicians; each group has also an orthopaedic surgeon, a neurologist, an ear, nose, and throat specialist, and a radiologist, all of them as far as possible from the teaching staff of the university medical school. By thus putting into active service a "team" of men who have already been accustomed to work together, it is believed that the best technical results can be obtained. The Columbia unit, for example, consists of doctors and nurses who have been working together at the Presbyterian Hospital in New York in the same capacities as those to which they are now assigned.

At the request of the British Commission which recently visited Washington, six of these thirty-eight hospital units have been lent to the British Government with a view to releasing the staffs already at the base hospitals. As originally organized, the unit, when called out, intended to carry its own complete equipment, but as these six units were requested to take over six general hospitals already in being, only some special instruments and not the full equipment have been brought across the

Atlantic. Major Brewer also indicated an interesting development for the immediate future. For some time it has been planned by the National Red Cross of America to provide each of these units with a complete set of hospital buildings of the portable house type. The plans were formulated by Dr. Sidney A. Burnap, a member of the Columbia unit, and have been approved by the Council of National Defence. Through the generosity of a New York philanthropist orders have been given for the construction of a set of hospital buildings capable of accommodating 500 patients, staff, and administrative personnel, and including operating theatre, kitchen, laundry, heating, lighting, and disinfecting plant, sewerage system, and all labour-saving devices on the most up-to-date lines. Between forty and fifty buildings (forming one set) are now being constructed on this portable plan, capable of being erected and made ready for use within two or three weeks, so as to form a base hospital; when this model building is completed it will be placed on exhibition, either in one of the parks of New York or at one of the military concentration camps, and if it proves as satisfactory as expected the Government will probably order ten or more of these groups of buildings to be constructed for base hospital use with the first expeditionary force to Europe.

In the official summary, issued on May 29th, of what the United States has accomplished during the seven weeks which have elapsed since it entered the war, it is stated that ten thousand doctors, in addition to many nurses, have been ordered to England and France. As the bill which is to be put into force forthwith will provide an army of 2,000,000 men, this is at the rate of one doctor to 200 men. It is, however, anticipated that not more than 100,000 Americans all told will be available in France at an early date, and it is to be assumed that all the ten thousand doctors will not come to Europe before the main American forces reach this country.

CASUALTIES IN THE MEDICAL SERVICES.

ROYAL NAVY.

Killed in Action.

TEMPORARY SURGEON A. McK. RUSSELL, R.N.

Temporary Surgeon Archibald McKerrow Russell, R.N., who was reported as missing in the casualty list published on May 19th (BRITISH MEDICAL JOURNAL, May 26th), is reported as killed in that of May 26th. He was educated at Glasgow University, where he graduated as M.B. and Ch.B. in 1914, and was a resident of Newmains, Lanarkshire.

ARMY.

Killed in Action.

Captain William Gordon Cummings, R.A.M.C.(T.F.).

CAPTAIN F. HUNTON, R.A.M.C.(T.F.).

Captain Frederick Hunton was killed in action on May 6th, near Gaza, in Palestine, and a brief summary of his professional career was printed in the JOURNAL of May 19th, 1917. A medical colleague sends us an appreciation of his life and character, from which we make the following extract: "Frederick Hunton was the ideal country practitioner, and by his cheery courage, professional skill, and sterling character he wielded a wide influence for good. He loved the life of the country, and his favourite holiday was a ride on horseback alone with Nature. He was devoted to hunting and outdoor exercise, and his physical courage brought him many accidents. This fearlessness was characteristic throughout his life and in his death. After seeing the wounded come in from action near Gaza, and on one occasion working amongst them for eighty-four hours with only four hours' sleep, Hunton was killed by a piece of bomb whilst running to succour the wounded who fell during a bombing raid."

Lost at Sea.

The casualty list published on May 28th contained the names of twenty-two officers reported as "missing, believed drowned," including four of the R.A.M.C.—Captains C. A. W. Pope and A. Tilbury, Lieutenant J. E. B. Smith, and Lieutenant and Quartermaster A. T. Hasler, M.C. Two more R.A.M.C. officers were reported as drowned in the casualty list of May 29th—Captain H. H. Robinson, D.S.O., and Lieutenant J. T. Brown. Obituary notices of Lieutenants Smith and Brown have already been given (BRITISH MEDICAL JOURNAL, May 12th and 26th). Lieutenant Smith appears to have been lost in the *Arcadian* on April 15th. Captain Tilbury, and probably the others, were lost in the transport *Transylvania*, 14,000 tons, formerly an Anchor liner, torpedoed and sunk in the Mediterranean on May 4th.

CAPTAIN C. A. W. POPE, R.A.M.C.

Captain Charles Alfred Whiting Pope was educated at St. Bartholomew's Hospital, taking the diplomas of M.R.C.S. and L.R.C.P.Lond. in 1903, and at Cambridge, where he graduated as M.A. and B.C. in 1904, and as M.B. in 1907. After filling the posts of assistant house-surgeon of the South Devon and East Cornwall Hospital, and of house-physician of the Somerset Hospital at Capetown, he went into practice at St. Leonards-on-Sea. He took a temporary commission as lieutenant in the R.A.M.C. on April 12th, 1915, and was promoted to captain after a year's service. He had been for some time in medical charge of military families at Aldershot.

CAPTAIN H. H. ROBINSON, D.S.O., R.A.M.C.

Captain Henry Harold Robinson, D.S.O., was educated at Owens College, Manchester, and took the diplomas of M.R.C.S. and L.R.C.P.Lond. in 1899. After serving as house-surgeon of Burton-on-Trent Infirmary, as senior house-surgeon of Southport Infirmary, and as house-surgeon of Birkenhead Children's Hospital, he went into practice at Birkenhead, where he was honorary medical officer of the children's hospital. He took a temporary commission as lieutenant in the R.A.M.C. on April 10th, 1915, and was promoted to captain after a year's service. He received the D.S.O. on August 25th, 1916, and the Military Cross on November 14th, 1916.

CAPTAIN A. TILBURY, R.A.M.C.

Captain Arthur Tilbury, youngest son of Mr. John Tilbury of Oakley, Hants, was educated at Guy's Hospital, and took the diplomas of M.R.C.S., L.R.C.P.Lond. in 1913. He then joined his brother in partnership at Queen's Road, S.E., and continued to hold clinical appointments at Guy's Hospital. On the outbreak of war he was called up as a reservist in London University O.T.C., and was given a commission in the R.A.M.C. He served at Canterbury for a year, and on obtaining his captaincy was sent to Egypt in September, 1915. On March 17th he came to England on special duty, and on his return journey the *Transylvania*, on which he was on duty, was torpedoed and sunk on May 4th, and he was reported missing and believed drowned. His loss is keenly felt by his relatives, patients, and many friends at Guy's.

LIEUTENANT AND QUARTERMASTER A. T. HASLER, M.C., R.A.M.C.

Lieutenant and Quartermaster Arthur Thomas Hasler, M.C., R.A.M.C., was born on March 11th, 1875, and, after serving in the ranks for nearly eighteen years and as a warrant officer for two and a half years, received his commission on February 6th, 1915. He gained the Military Cross as a sergeant-major on January 1st, 1915, being one of the first recipients of that order on its institution.

Died of Wounds.

CAPTAIN H. A. WILSON, R.A.M.C.

Captain Robert Henry Wilson was reported as having died of wounds, in the casualty list published on May 29th. He resided at Straid, Ballyclare, County Antrim, and was educated at the University of Belfast, where he graduated as M.B., B.Ch., and B.A.O. in 1915. After qualifying he entered the R.A.M.C. as a temporary lieutenant, and was promoted to captain after a year's service.

Died on Service.

CAPTAIN R. F. RUSSELL, R.A.M.C.

Captain Robert Fergusson Russell, R.A.M.C., was reported as having died on service, in the casualty list published on May 28th. He was educated at Aberdeen University, where he graduated M.B. and Ch.B. in 1905, and was in practice in Jamaica, until he took a temporary commission in the R.A.M.C.

Wounded.

Lieutenant-Colonel J. J. Fraser, Canadian A.M.C.
Captain J. F. Bourke, R.A.M.C. (temporary).
Captain J. C. Ferguson, R.A.M.C. (temporary).
Captain J. A. Gilfillan, R.A.M.C. (temporary).
Lieutenant J. W. Mackie, R.A.M.C., S.R.
Captain H. N. Stafford, R.A.M.C. (temporary).

DEATHS AMONG SONS OF MEDICAL MEN.

Ardagh, Arthur Holford, Captain Canadian Infantry, only son of Dr. Edward Ardagh, of Orillia, Ontario, Canada, killed on May 10th, aged 23.

Codner, Christopher Cardew, acting Captain Prince Albert's Somerset Light Infantry, younger son of Dr. J. Codner, of Corfe, Taunton, reported wounded and missing on May 3rd, now reported killed, aged 22. He got his commission in July, 1915, and reached the rank of captain in November.

Dunwoody, John Myles, Second Lieutenant Royal Dublin Fusiliers, reported missing, believed drowned, on May 4th, on troopship *Transylvania* on his way back to Salonica after leave, only son of Dr. W. G. Dunwoody of Ramsgate.

Henson, Gordon Reed, Private, Canadian Forces, second son of the late Dr. J. R. Henson, of Hornsea, Yorkshire, died on May 17th of wounds received on May 8th.

Irvine, Gerard Byrom Currie, Major Indian Infantry, elder son of the late Inspector-General G. J. Irvine, R.N., died on May 15th of wounds received on April 21st. He was born on February 18th, 1881, and served with the Devon Militia during the South African war, in 1900-2, in the Transvaal, Orange River Colony, and Cape Colony, receiving the King's medal with three clasps and the Queen's medal with two clasps. He received a commission in the Leinster Regiment from May 4th, 1901, joined the Indian Army on March 18th, 1906, became captain on February 14th, 1909, and had recently been promoted to major. He had served for the last eleven years in the 9th Bhopal Infantry, and was with his regiment in France in 1914-15, being severely wounded in October, 1914.

Poole, B. R., Captain Canadian Forces, youngest son of Surgeon-Major Poole, of Norwood, killed on May 3rd.

Pye-Smith, Philip Howson Guy, Lieutenant Liverpool Regiment, only child of the late Dr. P. H. Pye-Smith, killed May 15th, aged 21. He was educated at Eton and entered Magdalen College, Oxford, in October, 1914, but took a commission on December 22nd, 1914. He went to the front in May, 1915, was wounded on Good Friday, 1916, and returned to the front last Christmas.

Sandoe, M. W. A., Second Lieutenant Devonshire Regiment, eldest son of Dr. Sandoe, of Broadclyst, Devonshire, killed May 7th, aged 21.

Wright, William Richard, Lieutenant Canadian Infantry, third son of the late Dr. Henry P. Wright, of Ottawa, killed May 13th, aged 19.

[*We shall be indebted to relatives of those who are killed in action or die in the war for information which will enable us to make these notes as complete and accurate as possible.*]

HONOURS.

A SUPPLEMENT to the *London Gazette* of May 26th contains a further list of honours and decorations conferred upon officers for gallantry and devotion to duty. Among the recipients are the following medical officers:

Bar to Military Cross.

Temporary Captain Reginald Peter Nutcombe Buckland Blunett, M.C., R.A.M.C., attached Highland Light Infantry.

For conspicuous gallantry and devotion to duty. He displayed great judgement and endurance in organizing the stretcher-bearers in the attack. He worked continuously throughout the day, exposed for many hours to very heavy hostile fire. (M.C. gazetted March 30th, 1916.)

Military Cross.

Temporary Captain Thomas Dowzer, F.R.C.S.I., R.A.M.C., attached Manchester Regiment.

For conspicuous gallantry and devotion to duty. He showed great personal bravery in moving about in the open under heavy fire, organizing his bearers, and assisting in the search for the wounded.

Captain Francis Heygate Ellis, M.C. Rhodesian Regiment.

For conspicuous gallantry and devotion to duty on many occasions. He has at all times displayed a total disregard of personal safety, and has set a fine example to all ranks.

Captain Thomas Graham, M.B., R.A.M.C.

For conspicuous gallantry and devotion to duty. He rendered invaluable assistance in evacuating the wounded under very heavy fire. He has at all times set a splendid example of courage and determination.

Captain Thomas Whittle Martin, M.B., R.A.M.C.(S.R.), attached Royal Scots.

For conspicuous gallantry and devotion to duty. He was of the greatest assistance in organizing the evacuation of the wounded across "No Man's Land" during the operation. He has on many previous occasions done fine work.

Temporary Captain Francis Lorne McKinnon, M.D., R.A.M.C.

For conspicuous gallantry and devotion to duty. He personally led a search party up to the enemy wire in front of the village, under very close rifle and machine-gun fire. He succeeded in recovering two wounded men.

Temporary Captain Charles O'Brien, M.B., R.A.M.C.

For conspicuous gallantry and devotion to duty. Although wounded, he insisted on remaining in command of the bearer division of his field ambulance, and in so doing materially expedited the removal of the wounded from the field.

Captain Bertrand Cecil Owens Sheridan, M.B., R.A.M.C., Special Reserve, attached Worcester Regiment.

For conspicuous gallantry and devotion to duty. He tended the wounded continuously for twelve hours under very heavy fire. He set a splendid example of courage and determination throughout.

Captain George Charles Willcocks, Australian A.M.C.

For conspicuous gallantry and devotion to duty. He worked continuously for about sixteen hours in the open under heavy fire, and successfully evacuated a large number of wounded men. He set a splendid example of courage and determination.

The Distinguished Conduct Medal for acts of gallantry and devotion to duty has been awarded to two non-commissioned officers of the South African M.C., the Military Medal to two staff nurses of Queen Alexandra's Imperial Military Nursing Service Reserve, eight non-commissioned officers and privates of the R.A.M.C., to six of the Australian A.M.C., and to one temporary sergeant of the New Zealand Field Ambulance. The Meritorious Service Medal for valuable services rendered in the field has been bestowed upon two sergeants of the R.A.M.C.

MENTIONED IN DISPATCHES.

The following officers and men of the Army Medical Service and Royal Army Medical Corps are included in the list of names submitted by Sir Douglas Haig in his dispatch of April 9th as deserving of special mention:

ARMY MEDICAL SERVICE.

Head Quarters Staff.

Lieutenant-General Sir A. T. Sloggett, K.C.B., C.M.G.

Surgeon-Generals: W. G. Macpherson, C.B., C.M.G., M.B., M. W. O'Keefe, C.B., M.D., R. Porter, C.B., M.B., R. H. S. Sawyer, C.M.G., M.B., F.R.C.S.I., T. P. Woodhouse, C.B.

Colonels (temporary Surgeon-Generals): J. M. Irwin, W. W. Pike, C.M.G., D.S.O., F.R.C.S.I., B. M. Skinner, C.M.G., M.V.O.

Colonels: A. W. Bewley, E. G. Browne, C.B., C. H. Burtchaell, C.M.G., M.B., H. Carr, C.B., M.B., J. J. Gerrard, M.B., R. Jackson, M.B., R. Kirkpatrick, C.M.G., M.B., Sir W. B. Leishman, C.B., F.R.S., M.B., F.R.C.P., D. M. O'Callaghan, J. J. Russell, C.B., M.B., S. Westcott, C.B., C.M.G.

Temporary Colonel C. C. Fleming, D.S.O., M.B., ret. pay (Res. of Off.).

Lieutenant-Colonel and Brevet Colonel H. Ensor, D.S.O., M.B.

Lieutenant-Colonels (temporary Colonels): J. D. Alexander, M.B., H. P. W. Barrow, C.M.G., W. C. Beevor, C.B., C.M.G., M.B., ret. pay, R. J. Blackham, C.I.E., D.S.O., E. W. Bliss, D.S.O., A. W. N. Bowen, G. W. Brazier-Creagh, C.M.G., ret. pay, J. Grech, D.S.O., F. J. Greig, ret. pay (Res. of Off.), H. A. Hinge, C.M.G., A. W. Hooper, C.M.G., D.S.O., S. de C. O'Grady, M.B., J. Poe, D.S.O., M.B., C. E. Pollock, D.S.O., M. McG. Rattray, M.B., D. D. Shanahan, D.S.O., F. A. Symons, C.M.G., D.S.O., M.B., H. S. Thurston, C.M.G.

Lieutenant-Colonels (acting Colonels): J. G. Gill, H. Herrick.

Lieutenant-Colonels: W. W. O. Beveridge, C.B., D.S.O., M.B., W. R. Blackwell, S. L. Cummins, C.M.G., M.D., H. B. Fawcus, C.M.G., M.B., L. N. Lloyd, C.M.G., D.S.O., C. K. Morgan, C.M.G., M.B.

Majors: H. St. M. Carter, D.S.O., J. A. Hartigan, D.S.O., M.B., N. Low, D.S.O., A. H. MacN. Mitchell, J. D. Richmond, M.B., M. B. H. Ritchie, D.S.O., M.B., G. F. Sheehan, S. B. Smith, M.D., J. A. Turnbull.

Captains: D. C. G. Ballingall, M.C., M.B., J. J. H. Beckton, F. Casement, M.B., K. K. Drury, M.C., A. J. Gibson, M.B., F. A. McCammon, M.C., M.B., H. F. Panton, M.C., M.B., G. S. Parkinson, G. P. Taylor, M.C., M.B., H. F. Wilkin, M.C., F.R.C.S.E.

Temporary Captains: G. J. D. Hindley, M.B., E. S. Marshall.

Lieutenant (temporary Captain) J. H. Pendered, M.B., F.R.C.S.

Consultants.

Temporary Surgeon-General Sir G. H. Makins, K.C.M.G., C.B., F.R.C.S. (Lieutenant-Colonel 2nd London General Hospital, R.A.M.C.).

Temporary Colonels: Sir J. R. Bradford, K.C.M.G., C.B., F.R.S., M.D. (Major 3rd London General Hospital, R.A.M.C.), F. M. Caird, M.B., F.R.C.S.E. (Lieutenant-Colonel 2nd Scottish General Hospital, R.A.M.C.), Sir B. E. Dawson, K.C.V.O., C.B., M.D. (Captain 2nd London General Hospital, R.A.M.C.), W. T. Lister, C.M.G., M.B., F.R.C.S., C. S. Wallace, C.M.G.

ROYAL ARMY MEDICAL CORPS.

Lieutenant-Colonels: S. A. Archer, C. R. Evans, D.S.O., T. Fraser, M.B., G. H. Goddard, F. W. Higgs, M.D., C. H. Howkins, W. E. Hume, M.B., D. D. Logan, M.D., E. W. P. V. Marriott, A. H. Waring, E. A. Wraith.

Temporary Lieutenant-Colonel R. H. M. Roberts, C.M.G., T.D., F.R.C.S.E.

Majors (temporary Lieutenant-Colonels): D. Ahern, R. Coffey, J. F. Crombie, B. H. V. Dunbar, M.B., G. H. L. Hammerton, H. C. Hildreth, F.R.C.S.E., A. B. Hinde (Res. of Off.), G. J. Houghton, T. Kay, M.B., W. D. C. Kelly, M.B., C. H. Lindsay, C.M.G., M.D., J. E. Powell, T. P. Puddicombe, M.B.,

J. Rahilly, M.B., H. Rogers, M.B., D. Rorie, M.D., W. M. B. Sparkes, D.S.O., H. Stewart, M.C., M.B., R. J. C. Thompson, D.S.O., R. M. West, M.D., T. J. Wright.

Major (acting Lieutenant-Colonel): A. J. Hull, F.R.C.S.

Majors: G. E. Gask, F.R.C.S., J. M. Gover, M.B., W. B. Milbanke, M.B., G. W. Miller, M.B., J. S. Pascoe.

Temporary Majors (temporary Lieutenant-Colonels): W. B. Edwards, E. L. Gowlland, M.B.

Captains (Acting Lieutenant-Colonels): J. D. Bowie, M.B., E. D. Caddell, M.C., M.B., H. K. Dawson, M.D., W. H. Forsyth, M.B., A. D. Fraser, M.C., M.B. (S.R.), A. S. Littlejohns, D. F. Mackenzie, D.S.O., M.B., G. Mackie, R. Magill, M.B. (S.R.), C. R. M. Morris, M.B., K. D. Murchison (S.R.), R. T. C. Robertson, M.B. (S.R.), M. R. Taylor, M.B. (late Captain A. Med. Res.), A. G. Wells, A. J. Williamson, M.D.

Captains (temporary Majors): E. Alderson, M.D., R. S. Taylor, M.B., F.R.C.S.E.

Captains: W. W. Adamson, M.B., F. J. Allen, M.B., G. N. Anderson, M.B., R. P. Ballard, M.B. (S.R.), T. W. Browne, C. F. Burton (S.R.), A. Campbell, M.B., T. F. Corkhill, M.B., (S.R.), N. A. Coward, M.D., E. M. Cowell, M.D., F.R.C.S., R. S. Cumming, M.B., A. M. Deane, M.B., A. E. Delgado, M.B., W. J. Dowling (S.R.), S. R. O. Dudfield, M.B., P. W. Edwards (S.R.), H. Foxton, M.B., A. F. Girvan, J. Golding, C. M. Gozney, M.B., J. M. Hamill, W. H. P. Hey, M.B., F.R.C.S., A. M. Hughes, C. Jacobs (S.R.), D. W. John (S.R.), H. W. Lance, M.B., H. Lightstone, M.C., P. McCallum (S.R.), H. E. McCready, M.D., H. W. Maltby (S.R.), D. M. Marr (S.R.), R. P. S. Mason (S.R.), E. R. Matthews, G. L. Matthews, W. T. P. Meade-King, E. J. Messent, F. R. H. Mollan (S.R.), B. B. Morgan, M.D., W. F. Munro, M.B., T. S. Nelson (S.R.), J. A. Nixon, O. G. Parry-Jones, S.R. (died of wounds), L. T. Poole, M.B., A. D. Ramsbottom, M.D. (S.R.), A. E. Rayner, D. G. Rice-Oxley, M.B., J. C. Rowe, M.B., A. A. Rutherford, J. A. C. Scott, M.C., M.B., T. G. Shand, A. H. Spicer, M.B., W. C. Stewart, M.B., A. P. Thomson, G. T. van der Vyver, M.B. (S.R.), H. Vickers, J. S. Wallace, W. J. Webster (S.R.), L. T. Whelan, F.R.C.S.I., C. S. E. Wright, M.B., S. K. Young, M.D. (S.R.).

Temporary Captains (acting Lieutenant-Colonels): R. E. Drake-Brockman, F. F. Muecke, M.B., F.R.C.S.

Temporary Captains: T. E. Amyot, M.B., W. A. Anderson, M.B., B. W. Armstrong, V. E. Badcock, M.D., S. Batchelor, J. Biggam, M.B., A. G. Bisset, M.B., J. C. Boyd, M.D., C. A. Brisco, M.B., D. S. Brough, M.B., W. T. Brown, M.B., C. W. G. Bryan, F.R.C.S., F. Carson, M.B., H. Carson, M.B., C. N. Coad, M.B., H. M. Cockcroft, R. C. Cook, E. W. Craig, M.B., J. Crawford, M.C., J. Davidson, M.B., C. F. Dillon-Kelly, C. O. Donovon, D.S.O., M.B., C. G. Douglas, M.C., M.D., J. J. Dwyer, H. D. Eccles, C. M. G. Elliott, J. H. Elliott, M.D., C. C. Finlator, M.D., S. J. C. Fraser, M.D., H. B. German (late Surgeon, R.N.), R. S. Gibson, M.B., N. F. Graham, M.B., N. Grellier, J. D. Hart, M.B., W. S. B. Hay, M.B., G. W. Huggins, D. M. Hunter, M.B., A. H. Huycke, M.D., G. W. B. James, M.D., D. S. Jones, D. W. F. Jones, M.B., J. Kirker, J. Kirton, M.B., J. St. P. Knight, M.B., H. A. Lake, F. J. Lidderdale, M.B., W. H. R. McCarter, M.B., W. McCready, M.B., F.R.C.S.I., N. MacDonald, M.D. (Lieut. C.A.M.C.), J. W. McKinney, M.B., J. W. McLeod, M.B., M. T. McMahon, M.B., R. J. B. Madden, M.B., J. R. Marrack, M.C., M.B., H. C. D. Miller, M.B., W. Millerick, R. S. Morshead, K. M. Nelson, H. B. Owens, W. H. Parry, M. P. Paton, M.B., D. H. Pennant, D.S.O., S. E. Picken, M.B., J. H. Porter, M.B., K. Pretty, M.B., M. Ramsay, M.B., G. A. Renwick, M.D., J. F. Robertson, W. Rogerson, M.B., H. B. G. Russell, W. Russell, A. P. Saint, A. D. Sharp, M.D., T. Sheehan, G. R. Spence, A. V. Stocks, M.B., R. Tindall, M.B., R. W. L. Todd, M.B., W. A. Troup, M.B., R. B. Wallace, M.B., G. R. C. Wilson, J. A. Wilson, M.B., H. Young.

Lieutenants (temporary Captains): R. Ellis, M.B., D. N. Macleod, M.B.

Lieutenant E. S. Bissell (since relinquished his commission).

Temporary Lieutenants: G. E. Chissell, A. A. Halliday, M.B., K. M. Walker, M.B., F.R.C.S.

Quartermasters and Honorary Majors: J. Green, W. M. Moreton, H. Spackman.

Quartermasters and Honorary Lieutenants: G. S. Annett, R. J. Fleming, M.C., J. Jackson, J. King, J. W. Osborne, A. G. Powell, W. J. Rice, G. Sellex.

Temporary Quartermasters and Honorary Lieutenants: A. H. Addey-Jibb, C. O. Elliot, J. R. Kenshole, A. Morrison, G. R. Spring, J. Tewkesbury.

The list also includes 97 non-commissioned officers and men of the R.A.M.C., 11 members of Queen Alexandra's Imperial Military Nursing Service, 6 of Queen Alexandra's Imperial Military Nursing Service Reserve, 11 of the Territorial Force Nursing Service, 14 of the Civil Hospital Reserve, 28 of the Women's Voluntary Aid Detachment, 3 of the First Aid Nursing Yeomanry, 2 special military probationers, 14 of the British Red Cross Society, 4 of the Voluntary Aid Detachment, 13 lady helpers, and one representative of the American Nursing Service.

NOTES.

HOSPITAL FOR DISABLED OFFICERS.

THE Sir John Ellerman Hospital, primarily intended for disabled officers discharged or about to be discharged from the service, is situated in beautiful grounds, the leading idea being to make it as homelike as possible. The authorities desire such officers to feel that when they have been there some time and wish for a change they can go away and return later. Any beds not required at the moment for disabled officers are being utilized by the War Office for convalescent patients from abroad. Medical officers in charge of hospitals are asked to remember when discharging disabled officers that the Sir John Ellerman Hospital was fitted up for their benefit. It has an *x*-ray room and appliances for electric treatment and massage. On application to the secretary at Walkhurst Lodge, Benenden, Cranbrook, Kent, forms of admission for officers will be sent.

FOLKESTONE AIR RAID.

The following notes show the help given during the raid on May 25th, 1917, to the civilian population by the Canadian Army Medical Corps at present on duty in this neighbourhood:

As soon as the raid was announced a dispatch rider was sent to the ambulance dépôt with a message to send ambulances forward. The first on the scene was one stationed permanently at West Cliff Military Eye and Ear Hospital, Folkestone. First aid was given locally, and the cases were collected to a first aid post at the West Cliff Eye and Ear Hospital, which is in the town, and will be known to many as the West Cliff Hotel. The first case reached the hospital ten minutes after the raid, and in thirty or forty minutes all the cases had been admitted. From it the cases were distributed to the civilian hospital, or, if requiring serious surgical operations, to Moore Barracks Hospital, Shorncliffe. The staff at Victoria Civilian Hospital was reinforced by four Canadian surgeons.

The Town Commandant has expressed his great satisfaction with the service rendered.

The offices of the Wounded Allies Relief Committee have been removed to Bank Chambers, 329, High Holborn, W.C.1.

England and Wales.

THE WELSH NATIONAL LIBRARY.

IT was announced at a meeting of the court of governors of the National Library of Wales on May 25th that the whole of the building contracts had been completed, and that the total expenditure had been £110,563, leaving a small balance in hand. The library owes more to Sir John Williams than to any other man, and in particular, that it already possesses a collection of Welsh books and manuscripts which make it the foremost library of Celtic literature in the world. Everyone will be glad to know that he has lived to see the fine building on the commanding site on Grogythan Hill, overlooking the bay of Aberystwyth, in which the treasures he has presented to his country are worthily housed. The beautiful reproduction of the Black Book of Carmarthen, edited by Dr. Gwengvryn Evans in 1906, is dedicated to Sir John Williams as "the first President of the Welsh National Library, the first in personal effort for its establishment, the first in personal sacrifice for its good, and the first in the importance of his contributions to its treasures." In reporting the meeting last week the *Western Mail* states that Sir Herbert Lewis, M.P., who presided, said that Wales could do nothing better at the present time than help forward that orderly, progressive, national development typified by the Welsh National Library. One development of the library may here be mentioned: it is that it keeps in circulation duplicate copies of books for the use of lecturers and tutorial classes held throughout the principality.

NOTIFICATION OF BIRTHS IN SALFORD.

At a recent meeting of the practitioners of Salford a resolution of a previous meeting was confirmed to the effect that "as notification of births by the practitioner in attendance is a breach of that professional secrecy which we are bound to observe, we refuse to notify." The feeling was strongly expressed that the confidential relationship between doctor and patient is being insidiously undermined by the legislation of the last few years, the Notification of Births Act being a glaring example of this. At first the doctor in attendance at a confinement was made jointly responsible with the parents for the notification, but as the Act was optional, and as many local authorities did not adopt it, the first protest of the profession soon became

broken and feeble. In areas where the Act was adopted many practitioners simply ignored it, or took refuge in the provision which excuses the doctor if he can prove that he had reasonable grounds for believing that notice had been duly given by some other person. Even this involved the doctor in the necessity of instructing the parents in their legal duty. But, to a great extent, the Act was a failure, partly because most of the well organized local authorities had other means of getting all the information about births that could be of any practical advantage without imposing on the doctor a task which is repugnant to his better nature. A further step was then taken of withdrawing the optional character of the Act and compelling local authorities to adopt it. But it still met with passive resistance, and the Government has recently taken a step which quite clearly foreshadows an attempt to compel medical practitioners to notify births, and local authorities have recently issued a circular to practitioners which is nothing less than a threat if they fail to notify. The effect of this at a time when the profession is giving so freely of its services to the country cannot fail to be disastrous. Side by side with this is placed the reduction of the ordinary notification fees for infectious diseases. There is no use in hiding the fact that the profession generally both in Manchester and Salford have the conviction that things might have been much more satisfactory if the British Medical Association had shown a firmer attitude in dealing with the Local Government Board, which appears to be constantly on the look-out for means to make the position of general practitioners more and more intolerable.

The Hygiene of Mercantile Ships.

The Liverpool Port Sanitary Authority has issued *A Report on Marine Hygiene*, by Dr. William Hanna, assistant medical officer of health for the Port of Liverpool, based on an essay which gained the Henry Saxon Snell prize and medal of the Royal Sanitary Institute. The report consists of practical suggestions for improvements in the sanitary arrangements and appliances on shipboard. The author points out that much progress in the building of ships on hygienic lines has recently taken place, but the evolution of marine hygiene has not kept pace with the advance of sanitation on land. Whatever steps are being taken to speed up construction of merchant ships, in view of the present crisis, it is to be hoped that the health and comfort of the seamen will not be neglected. Dr. Hanna's report is therefore timely, since the health of the mercantile marine is only second in importance to that of the personnel of the Royal Navy. Fleet Surgeon Munday's article on naval hygiene, which we printed on April 28th, showed the importance attached by the Naval Medical Department to sanitation afloat, so that the war instead of lowering the standard has raised it, with the result that the physical efficiency of all ratings in the navy is higher now than at any previous time. Ventilation on board ship has been the subject of continual inquiry and experiment in the navy, and Dr. Hanna dwells especially on the need for improvement in this matter in mercantile vessels. He points out that the situation of crew spaces and their ventilation are perhaps the two most important problems in marine hygiene. Owing to the great variety in shape, size, and purpose of trade vessels he has had to treat the subject on broad lines only. Other cognate matters which he discusses are the heating, lighting, and drainage of crew's quarters, water supply, filters, and lavatories; the disposition of berths, bunks, and mess rooms; and the provision of hospital accommodation. The last-named point he regards as especially important in view of the occurrence of infectious disease on board. "It seems very strange," he says, "how thoughtlessly the plans of ships are drawn up by naval architects when so important a point is frequently overlooked." The report ends with a number of clear diagrams illustrating the author's suggestions.

Scheme for Venereal Treatment in Brighton and Sussex.

The board of management of the Royal Sussex County Hospital, Brighton, has entered into an agreement with the Brighton Town Council and the County Councils of East and West Sussex for the establishment of a centre for the treatment of venereal diseases, which agreement has been submitted to the Local Government Board for approval.

The scheme provides for an out-patient department for the diagnosis and treatment of venereal diseases in both sexes, where patients are to be treated free of charge, provided they are not willing to be treated privately, or cannot be treated satisfactorily by their own doctor. As far as possible the treatment will be carried out in consultation with the patient's own doctor. No distinctive name, indicating venereal treatment, is to be given to the clinic. Medical officers who have special experience in venereal diseases and a knowledge of modern methods of diagnosis and treatment are to be appointed. These medical officers will undertake the following duties:

1. Attendance at the clinic and the examination and treatment of patients, both out and in.
2. The keeping of records of the patients' progress and treatment.
3. Consultation with medical practitioners in cases sent by them.
4. Taking of specimens for pathological examination and consultations, when necessary, with the pathologist.
5. Supply of salvarsan or its substitutes to medical practitioners.
6. Transmission of reports to medical officers of health. The medical officers will also give demonstrations at the clinic to registered medical practitioners as to the methods of taking and transmitting material for laboratory diagnosis, and as to the best known methods for the systematic diagnosis and treatment of venereal diseases.

Two beds are to be reserved for in-patients requiring salvarsan or other drugs given by intravenous injection, and for the temporary treatment of certain acutely contagious cases of gonorrhoea. Two additional beds are to be available if necessary. Cases requiring prolonged treatment are to be treated at the hospital only in exceptional cases.

Arrangements are made in the agreement for the adequate remuneration of the medical officers to the clinic. The scheme has met with the approval of the Executive Committee of the local Division of the British Medical Association.

Scotland.

Meat from Tuberculous Cattle.

A PARAGRAPH in the *Glasgow Herald* of May 16th reported that the Paisley Public Health Committee had recently interviewed Major G. R. Leighton, veterinary medical inspector to the Local Government Board for Scotland, on the subject of economy in meat consumption. The Scottish Local Government Board is stated to have come to the conclusion that those portions of the meat of tuberculous cattle which were not visibly affected might be used for food if sterilized, and the Public Health Committee was asked whether it would support the sale of such meat, as the health authorities of Dundee, Aberdeen, and Hamilton were already doing. The Paisley Town Council, after a discussion of the report, decided to defer action for a month. The question of what should be done with the flesh of animals affected with tuberculosis has long exercised the minds of hygienists and veterinary surgeons attached to Continental slaughter-houses. In Germany, as Dr. T. M. Legge has stated,[1] a ministerial decree issued in 1892 allowed considerable latitude in the sale for human consumption of the meat of tuberculous cattle; and the flesh of animals with tuberculosis confined to one organ, or to several organs lying in the same cavity and not connected with one another by lymph channels or by blood vessels belonging to the systemic circulation, was permitted to be sold for food. Dr. Legge points out that the result of this was that large quantities of meat which formerly would have been condemned came upon the market. For the sterilization of the meat of animals affected with tuberculosis not sufficiently extensive to demand total seizure, nor so slight as to allow its sale without restriction, large steam disinfectors were erected at the Berlin abattoir. This meat is cut into pieces, and sterilized by contact with steam under pressure, and sold at greatly reduced prices in a special corner

[1] *Public Health in European Capitals.* London: Sonnenschein and Co.

of the abattoir, labelled, "Sale of the cooked meat of tuberculous animals," where it finds a ready market among the poor.

Dr. David Newman, in a letter which we have not space to print in full, criticizes severely the action of the Scottish Local Government Board in suggesting to local authorities that they should follow the German practice of reclaiming condemned meat by sterilization. Our correspondent admits that the flesh of tuberculous animals may possibly be rendered harmless by sterilization, but he doubts whether the food problem is so serious as to call for this infringement of legal provisions for the protection of the public from diseased meat. He quotes from the Public Health Scotland Act, 1891, in order to prove that the Local Government Board has no power to allow the sale of tuberculous flesh, and that meat which is diseased is forbidden by law to be exposed for sale. As a final point, Dr. Newman claims that the meat provisions of this Act have had a great influence in reducing the number of cases of bovine tuberculosis among the poor in Scottish hospital practice.

Canada.

THE PROPOSED SIX-YEAR COURSE IN MEDICINE.

THE decision of the universities of Toronto and McGill to extend the medical curriculum to six in place of five years, beginning with 1918, has met with serious objection on the part of the Senate of Queen's University, Kingston. The proposed change has been under consideration by the universities of McGill and Toronto for some time, and at the Conference of Canadian Universities held in Toronto in May, 1915, a Committee on Medical Education was appointed to report to the next conference. The report of this committee was presented to the third conference in May, 1916, and its recommendation that the conference should express approval of the adoption by Canadian medical schools of a six years' medical course as a minimum was unanimously accepted, and transmitted to the several provincial medical boards throughout the dominion. Approval of the suggested change was signified by Western University, London, Ontario, and on its own initiative, in May, 1916, the University of Manitoba announced that it would introduce a six years' course in medicine.

It is proposed that a pre-medical year shall be added to the five-year course, to be taken after matriculation and devoted to physics, chemistry, biology, and one literary subject (French or German), the course of instruction to include three lectures and six hours of laboratory work a week in physics, chemistry, and biology, and four lectures in French or German, taken at any college, university, or collegiate institute whose equipment and staff is sufficient. To this it is objected by Queen's University that the pre-medical year proposed could not be taken at any institution other than a university, since the laboratory equipment would be insufficient, and it is asked, Why not raise the standards in such a way as would harmonize with the present work of the secondary schools? In reply to this, the University of Toronto agrees that it is impossible at present for the collegiate institutes or secondary schools of the Province of Ontario to undertake the work, but expresses the hope that the action of the university will furnish a stimulus, and that before long it will become possible for the work to be done at these schools.

The proposal to give the degree of B.Sc. in medical sciences at the end of the second year of the regular medical course to students who, in addition to the regular work of the first and second years in medicine, have done special work in anatomy, physiology, or biological chemistry, meets with particular objection from Queen's University on the ground that its degree of Bachelor of Science now requires honour work in mathematics, followed by four years' work, and that such a degree would almost certainly replace the B.A., M.D. course of seven years, which is now taken by about 20 per cent. of the medical students of the university. The answer to this, made by the University of Toronto, is that the outline as set forth in the Queen's memorandum is so far only a proposal of the Faculty of Medicine, and has not yet been adopted by the Senate of the University of Toronto, and that, furthermore, there is no common policy of the universities in regard to the degree of Bachelor of Science.

Other objections raised by Queen's University are that, were a graduate obliged to do six years' academic work in order to obtain the degree of M.D., he would be disinclined to spend another year as hospital interne, and that the proposal to extend the medical course is inopportune, since the demand for doctors is unusually great at the present time. The University of Toronto replies to the first that, in its opinion, this will not be borne out by facts, and that the chief purpose of the change is to increase the hospital experience under direct clinical instruction. As to the demand for doctors, it is pointed out that any decrease in the supply of graduates in medicine will not come into effect until 1922, and that of recent years the medical schools of the province of Ontario have been providing more graduates in medicine than the province could absorb; that the western provinces are developing rapidly, and that there is no reason to suppose that for a few years after the war there will be any greater dearth of medical men in the west than there has been in the past.

It is contended also that the proposed change follows the development of medical education in the United States, which is based upon the German rather than the British methods, and that such changes should not be instituted while the whole subject of medical education is under investigation by the Medical Council of Canada and the Royal Commission appointed by the Ontario Government. Reply is made by the University of Toronto that the best universities in the United States are in line with the best British and Continental practice, and reference is made to the Educational Number of the BRITISH MEDICAL JOURNAL of September 9th, 1916, p. 348, where the normal course of study for medical students in Britain is outlined.

Lastly, the financial aspect of the matter is considered. It is pointed out by Queen's University that the expenses incurred by a medical student have increased already from 1,321 dollars in 1894 to 2,500 dollars at Queen's, and are proportionately heavier at Toronto and McGill, as living expenses are higher in either Montreal or Toronto than at Kingston, and that the addition of a sixth year will make it impossible for the son of an average working man to enter the profession. Answer to this objection is made by the University of Toronto by reference to the fact that the expense of a medical education in the University of Toronto is less than in Britain or in the leading schools of the United States, and that in all probability the governors of the university will impose a smaller fee for the pre-medical year than for the regular years in medicine. Emphasis is laid also upon the necessity of providing Canadian students with an opportunity of procuring the best medical education in their own country, so that they will not find it necessary to study elsewhere.

Correspondence.

FUTURE MEDICAL POLICY.

SIR,—I was pleased to read the letter of Dr. W. Gordon in the JOURNAL of May 19th, and I sincerely hope the moderate manner in which he has drawn attention to a future medical policy will stimulate all members of the profession to realize the nature of the crisis in the practice of medicine. I would also ask those members of the profession who have always prided themselves on having nothing to do with medical politics because they are not affected by any legislation, are not interested in the Insurance Act, and have no panel patients, to consider seriously the rapid developments taking place in medical legislation affecting medical practice from the highest consultant to the humblest general practitioner. I have no desire to open any new controversial questions, the more so as the Representative Meeting of the Association is to be held in July; but I have no hesitation in stating my personal opinion, which is in accord with Dr. Gordon's, that a part-time State service is the solution of the problem which has now arisen. In this connexion the profession must realize the present position of voluntary hospitals, and recognize the change in social and economic conditions since their foundation.

Every one knows the extraordinary good work which our profession has so long gratuitously given to the poor

and to charity through the voluntary hospital system, but we also know that these hospitals do not supply one-third of the requisite needs of the sick poor. Further, the interference of the State in the treatment of certain specific diseases and the Employers' Liability Act with the Medical State Insurance justify assertions in speeches of Labour members that working men accept hospital treatment not in the form of charity but as their just rights.

These facts cannot be too fully appreciated by our profession, and I have always agreed with the late Sir Victor Horsley that State medical work should not be muddled up with charity.

The complete abolition of panel lists with a thorough reformation and reorganization in the working of the State Insurance Act should afford the means for every one to help the scheme to be a success and to command the confidence of the public.

The Ministry of Health must give gratuitous medical treatment to the necessitous poor without the stigma of pauperism. It should be so organized by the formation of proper clinical surgeries, to which specialists would attend, that the service would attract our best men, keen and interested in their work, to apply for the appointments. There should be a part-time service, allowing for proper co-ordination and co-operation between domiciliary and institutional treatment. Undoubtedly there should be State control of medical education. We know in England there are eleven universities and three medical corporations, in Scotland four universities and three medical corporations, and in Ireland four universities and three corporations, all of which grant degrees and diplomas. The whole business is disjointed without central organization. We have long agitated in the Association that there should be one State examination before any one is allowed to practise.

Finally, I again ask members of the profession to give these questions their earnest and unbiassed consideration, free from any sentimental feeling which they may retain for old traditions. War has loosened the roots of many conservative institutions. Medicine has progressed with education and knowledge; let us progress further against the enemy of disease, to secure a healthy nation.—I am, etc.,

London, S.W., May 29th. G. E. HASLIP.

SIR,—The question of State Medical Service is well above the horizon. In discussing it, one side rhapsodizes over security of income, the beauties of work for work's and knowledge's sake, and a nicely ordered hierarchy for the medical officers and their satellites. The other side points out that in a salaried medical service no supervision could keep the lazy ones up to the mark (and none of us are always perfect); that promotion would be apt to be due to mere seniority or wire-pulling; that without the daily and hourly financial stimulus work would often be slovenly, and the patient would not have an easy means of defence against minor wrongs if our books were in order.

In fact, it is not the pros and cons of State but salaried service that are usually the bone of contention.

But must a public service be salaried? The exponents of "scientific management" point out that in the industrial world the best result is generally obtained by a combination of piece and time work rates of pay, or a minimum wage for a minimum amount of work, with a bonus for an increase in quality or quantity. Such systems of remuneration are successfully at work in large industrial organizations.

Is not this worth looking into by both the State and the profession? There are very few of us who are such hard-and-fast individualists as to regret having to work for the State if the advantages of the old system are retained whilst some of its disadvantages are removed.—I am, etc.,

Cambridge, May 27th. C. M. STEVENSON.

SIR,—I am glad to see that at last the Association is recognizing that it should advocate a part-time State service, instead of waiting until an inadequately paid whole-time service is thrust upon the profession, and most of the best men are therefore left standing outside.

The Association should fearlessly acknowledge that the attendance under the National Insurance Acts, which is itself a part-time State service, is an absolute failure, and amounts to little more than first aid carried on at an enormous cost. No adequate return can be made for the money expended until there is a proper linking up with consultant, specialist, and hospital treatment, and all members of the profession must be paid for the work they do. The system of voluntary hospitals is not consistent with a State service, nor under it is the general practitioner able to obtain a continuous knowledge of his patients, who must of necessity return to him for subsequent attendance, although they may have passed through the hands of specialists or surgeons.

There appears, however, to be a failure to recognize that all out-patient attendance can and should be given at central surgeries and not at the private houses of practitioners, where the waiting rooms are small, and one already hears of serious complaints in this respect. Individual surgeries are not suitable for proper attendance. There is no need for any hospital to have an out-patient department in its own building. The central out-patient dispensary should be completely equipped, and should be attended by not only general practitioners, but by specialists and consultants in all branches. Minor dressings would be attended to by nurses or dressers and the time of practitioners not wasted thereon; some qualified medical man would be continuously in attendance, and a second opinion always be obtainable on any case during dispensary consultations.

It must be recognized that the supply of drugs and dressings should be entirely done from the central dispensary and not from a number of little shops with no waiting room accommodation. The present system for insurance patients is inadequate and costly, and when special drugs are required they cannot be obtained. Every conceivable appliance and requisite—bed-rests, water-beds, splints of every description—should be kept for loaning out and returned. Both *x*-ray and pathological departments might properly exist at each dispensary; there would be no necessity to have separate dispensaries for tuberculosis or other diseases.

On such a system only can honest scientific attendance be provided for the bulk of the population, and the medical profession itself be satisfied that it is providing such. However, it must be recognized that in small country villages a difficulty would arise to bring the standard of attendance up to such an ideal.—I am, etc.,

HAROLD S. BEADLES,
Secretary Stratford Division and West Ham Panel Committee.

London, E. 16. May 26th.

ANAESTHESIA BY WARMED ETHER.

SIR,—Captain McCardie's contribution to your issue of April 21st (p. 508) raises many points of interest to the anaesthetist. The administration of C_1E_{15} with a bag was first suggested to me by an anaesthetist of London—I think Mr. Carter Braine—in April, 1904, but I have never ventured to give it by any closed method.

During two years' practice at the West End Hospital I commonly gave C_1E_7 to the children, for orthopaedic operations, from a Hewitt's A.C.E. inhaler, and found that the amount of each drug used was about half what one would expect to use of either alone.

As regards ether for soldiers, I fully agree with Dr. McCardie as to the value of small quantities of chloroform in mitigating the cough-provoking action of ether.

During the last six months, however, I have found that the mere addition of steam to the ether vapour has an equally good effect, and have now practically discarded both chloroform and morphine as accessory anaesthetics to ether. A little very hot water in the gasbag and a whiff or two of oxygen is sufficient to secure an easy induction in nearly every case, the anaesthetization being continued by means of a "draw over" ether apparatus,[1] with an arrangement to take up steam from a jug of hot water, without any rebreathing. The ether is inhaled constantly at a temperature of 85° to 95° F., fully moistened, and suffices for all kinds of operations except of course some on the chest and throat. The anaesthetist has both hands free for holding the jaw, as a rule, there being no bellows to work, and all adjustments of the

[1] Figured in the *Lancet*, September 2nd, 1916.

apparatus can be effected by one hand. The arrangements for regulating the strength of the ether vapour approximately are quite simple. My own work has become so much easier now that I think this method may be of use to others.

I hope to publish details of this steam ether method before long.—I am, etc.,

BERESFORD KINGSFORD, M.D.,
Anaesthetist, University College Hospital and Military Orthopaedic Hospital.

London, W., May 9th.

TREATMENT OF ASTHMA BY PEPTONE INJECTIONS.

SIR,—May I ask the indulgence of your columns in order to set at rest, if possible, certain doubts which have been expressed in a number of letters I have received from medical practitioners? The main question refers to sterilization of the peptone. The process of manufacture should ensure sterilization, involving as it does, amongst other things, evaporation to dryness *in vacuo*. If, however, any subsequent contamination be suspected, there ought to be no objection to heating the aqueous solution to 100° C., although up to the present I have not had any occasion to do so. Some correspondents suggest that sterilization by heating may destroy the activity of the peptone. That it does not do so, however, seems proved from the experiments of Vaughan and Wheeler, who, in their quest for the anaphylactic poison, split proteins, such as egg white, by boiling in absolute alcohol containing 2 per cent. of NaHO, and obtained an alcohol-soluble fraction which produced typical anaphylaxis in guinea-pigs. In like manner as regards serum, Besredka showed that its sensitizing properties were not lost even when heated to 120° C.

Other questions refer to the method of using the peptone. Dissolve the powder as formerly described for each injection. A stock solution should not be made. When pure, the peptone froths and evolves heat on being added to the water. Inject *deeply* into a suitable region of subcutaneous tissue poor in fat.

I have to thank Dr. Morton for his reference, but I fear he has not looked up my lecture to which allusion was made, in which the sentence occurs: "It will now be seen that this view of asthma is essentially that propounded by Bree," and was published by that physician over a hundred years ago.—I am, etc.,

London, W., May 25th. A. G. AULD.

REFRESHMENT HOUSE EXPERIMENT IN CARLISLE.

SIR,—The report in the BRITISH MEDICAL JOURNAL of May 19th, p. 663, under the above heading, would suggest that the experiment of State purchase and disinterested management of the liquor trade in the Carlisle district was proving an unqualified success; unfortunately, such is far from being the case.

There are two points in that report with which I wish to deal. The first has reference to the figures quoted regarding the number of convictions for drunkenness in April, May, and June, 1916 (the period immediately preceding the commencement of the operations of the Control Board), when they totalled 315, as compared with January, February, and March, 1917, for which period he gives the total as 159. It would be fairer to compare the first three months of 1916 with the corresponding period of 1917. They were as follows:

	January.	February.	March.	Total.
1916 ...	51	73	89	213
1917 ...	53	63	48	164

Here we have a difference of only 49; one would have been thankful for this small improvement, if it could be proved that the restrictive measures had played any important part in producing it; as a matter of fact, the operations of the Control Board had little or nothing to do in bringing it about, as at that period there were other factors at work which played an important part in its production. The first was a remarkable change in the character of the population occurring about the time the Control Board began its work; previous to this there was a tremendous influx of navvies into the locality—men who are known to be heavy drinkers. As these men completed their work they were replaced by munition girls. I submit that this fact would account for a considerable amount of the decrease in drunkenness at that time. Further, it was in March, 1917, that prohibition of the sale of spirits on Saturdays came into operation in the district, and was immediately followed by a remarkable fall in the number of convictions.

Your correspondent also infers that a further result of the experiment is that the people are eating more food and consuming less drink, and quotes the Gretna Tavern, where he tells us that the sales of food amount to 75 per cent. of the total takings. I would point out that the Gretna Tavern is primarily a restaurant and only secondarily a drinking saloon; also in many of the houses in the district no food is provided, sold, or obtainable, so that any comparison of figures on these lines can only be of value when we compare the relative quantities of food and drink sold in the whole of the houses in the area; such figures, if given, will disprove the theory advanced by your correspondent.

Judged from the standpoint of a temperance movement, the Carlisle experiment has been a colossal failure, as the following extract from the *Carlisle Journal* of January 2nd, 1917, goes to prove: "The convictions for drunkenness in Carlisle . . . in 1914 numbered 273, last year the total was 953, or three and a half times as many. . . . The Control Board's regulations have not yet produced any appreciable diminution in the number of convictions."

This and similar experiments go to prove that the liquor traffic is impossible of regulation and can only be effectually dealt with by means of total prohibition.—I am, etc.,

Plymouth, May 23rd. ROBERT SIMPSON.

MEDICAL BOARDS.

SIR,—Your space being limited, I would not have requested you to publish this letter if it only emphasized the complaint that we members of medical boards have received no thanks from the authorities for our very hard, onerous, and trying work.

No, Sir, its object is of far greater importance to us and to the State—namely, to bring to the notice of the profession several distinct grievances from which we suffer, with the desire of having them remedied.

To begin with, we have no status whatsoever, very few regulations—apart from the instructions regarding the method of examination of recruits—and so on. The only regulations concerning ourselves personally of which I am aware are (1) that we can resign or be dismissed by either party giving twenty-four hours' notice to that effect; (2) that if a member be ill for more than forty-eight hours he is obliged to send a medical certificate to the president of the board, stating the nature of the illness. If this be of brief duration and the member resume his duties within eight or ten days, he receives full pay (24s. a day) for the period of his absence. But, if the sickness be of longer duration—pneumonia, for example—and can be certified as such from the commencement, the examiner will receive at most three or four days' pay and be placed on the waiting list.

Next comes the question of leave. Up till now we have had only two or three days at Christmas and at Easter—no summer or bank holidays, whereas we ought to have, in addition, at least a fortnight in the summer, half a day in the week to attend to our private affairs, and bank holidays.

Then comes the question of the rate of pay, which is, as I have said, 24s. a day, and which is quite inadequate according to the present cost of living. Besides, I am given to understand that at Manchester and Liverpool the members are paid £2 a day. If this be a fact, the members of the London boards are very unjustly treated.

These grievances are important, but not so important as that concerning the number of recruits to be examined per day. With regard to this, the writer, having acted as an examiner for the past twenty-seven months in several districts and with many colleagues, is perfectly convinced that no man should be required to examine more than twenty five recruits a day. The latest instructions issued in this connexion state that each board of four members are expected to examine 130 recruits a day, that is, about thirty-two men for each examiner.

Well, Sir, I am fully convinced that no examiner can do

justice either to the recruits, the State, or to himself, if he should continue to examine such a number day after day. No one, unless he has acted as an examiner, can form an idea how fatiguing such work is both mentally and physically. The result is that before the end of the day we are almost completely done up.

In conclusion, we, like the rest of the profession, do not appear to be desirous of uniting together to obtain just treatment from the authorities. If I err in this, I would suggest that the members of the various medical boards in the London districts should hold a meeting on the earliest Sunday possible, to discuss and decide upon the necessary steps to be taken, in order to ameliorate and improve our present unenviable position. I suggest Sunday, for it is the only day we have free during the week. On Saturday we work the normal number of hours.—I am, etc.,

May 27th. A BELIEVER IN ACTION.

A WAY TO HELP ABSENT DOCTORS.

SIR,—The present and future financial needs of doctors on service must be great, but the contributions available are small. It seems to me that one proper source is neglected. Many doctors at home are doing war work gratis for the sake of their country, either from patriotism pure and simple, or partly for the sake of gaining credit, or even sometimes from laziness in face of the effort required to obtain remuneration due.

I think that where the medical man does not himself want this money—which he has as a rule more than earned—it is due to his profession, and should be devoted to those who have suffered financially by their patriotism, and that every man entitled to remuneration should make a point of using every effort to obtain money for his war services at home for the sake of those at the front when he does not need it himself.

I understand that many doctors have foregone fees for examining recruits, attending to soldiers on furlough or quartered locally (Army Forms O. 1666 and 1667), or doing V.A.D. hospital work. In many cases a great deal of persistence in application is required, and even then I know from personal experience payments that are due are often impossible to obtain. I have not yet been able to obtain payment for contract attendance on troops quartered locally, or payment for attendance on single soldiers (Army Forms O. 1666 and 1667) in many cases years old by now, or even for examining recruits under the Derby scheme, December, 1915; but I am now trying to obtain all that I can, and feel sure that if the plan were generally adopted much money might be obtained for the most needy and deserving of the profession, and perhaps if the British Medical Association itself gave a hand, or the secretary of one of the benevolent funds were authorized to collect for it, even more might be obtained.—I am, etc.,

May 16th. AN OVERWORKED PROFITEER.

THE GRIEVANCES OF TERRITORIAL MEDICAL OFFICERS.

SIR,—It would go a long way towards removing these grievances and be a very simple method if Mr. Churchill's Committee were to recommend that each year of continuous mobilized service of these officers should count two towards promotion and gratuity. The effect of this would be, if the war ends this year, that captains would obtain their majorities at the end of nine years' service and majors be promoted lieutenant-colonels at the end of twelve years' total service. It would double the gratuity to be paid at the end of the war and thus reduce the discrepancy between the remuneration of the Territorial and temporary officer. Further, accelerated promotion, I think, will induce men to remain in the Territorial Force after the war, but without some such inducements very few men will wish to retain their Territorial commissions, but prefer to bargain with the War Office for their services should occasion arise.—I am, etc.,

May 25th. O.C.

SIR VICTOR HORSLEY.

SIR,—Last July came the news of Sir Victor Horsley's death in Mesopotamia. We ought to have some record of his life and of his work; we cannot afford to forget him and what he did for medicine and surgery. I am collecting notes for a book; I hope that it will plainly show what we lost when we lost him. I ask for help in this venture from his friends and colleagues, and from the many patients, in hospital practice or in private practice, who have reason to be thankful for his skill and his kindness. I want all that they can tell me of him, and any letters of his which they will let me use. Without their help nothing that I can write of him will be of much service to anybody. Great care will be taken to return all letters.—I am, etc.,

STEPHEN PAGET.

21, Ladbroke Square,
London, W. 11,
May 24th.

The Services.

EXCHANGES.

M.O., attached to an infantry battalion in France, desires to exchange with a M.O. in an ambulance train, Red Cross barge, motor ambulance convoy, or fever hospital.—Address, No. 1549, BRITISH MEDICAL JOURNAL Office, 429, Strand, W.C.

Would an officer on Home Service care to exchange with an officer holding appointment on Lines of Communications? Easy exchange from this to Front Line could be arranged if desired. Territorial Officer preferred.—Address, No. 1650, BRITISH MEDICAL JOURNAL Office, 429, Strand, W.C.

Universities and Colleges.

ROYAL COLLEGE OF SURGEONS OF ENGLAND.

THE Secretary of the College has issued to the Fellows the annual official circular, informing them that a meeting of the Fellows will be held at the College on Thursday, July 5th, at 3 p.m., for the election of three Fellows into the Council in the vacancies occasioned by the retirement in rotation of Mr. W. Harrison Cripps and Mr. V. Warren Low, C.B., and by the death of Sir Frederic Eve. Blank forms of the requisite notice from a candidate and of his nomination may be obtained on application to the secretary, and the same must be received by him duly filled up within ten days from this date—that is, not later than on Friday, June 8th. A voting paper will be sent by post to each Fellow whose address in the United Kingdom is registered at the college on Tuesday, June 19th.

SOCIETY OF APOTHECARIES OF LONDON.

THE diploma of the Society has been granted to Messrs. J. Y. Dent, S. G. K. Kastelianski, R. H. Pettersson, F. A. Unwin, and L. J. Vincent.

Obituary.

FLEET SURGEON FLEETWOOD BUCKLE, R.N. (retired), died at Southsea on April 9th, aged 76. He was educated at St. Bartholomew's Hospital, and took the diplomas of L.S.A., L.R.C.P.Lond. and the degree of M.D. St. Andrews in 1862, and the M.R.C.S. in 1863. He entered the navy shortly afterwards; he attained the rank of fleet surgeon on May 26th, 1886. He had a long list of war service. He served as assistant surgeon of H.M.S. *Bristol*, flagship of Commodore G. T. P. Hornby, on the West Coast of Africa, taking part in various boat expeditions, when he was wounded in the hip, and went through a severe epidemic of yellow fever, for his services in which he received the thanks of the Admiralty. He was surgeon of H.M.S. *Alexandra*, flagship of Admiral Sir Geoffrey Hornby, at the passage of the Dardanelles in 1877. He was deputed to inspect the field hospitals and field ambulances in the Shipka Pass during the Russo-Turkish war of 1877–78, for which he received the Turkish war medal, and the thanks of the Stafford House Committee. In 1880 he was staff surgeon of H.M.S. *Kingfisher* on the West Coast of South America, and received the thanks of the Chilian Government for his services to the wounded in the battles round Lima in the war between Chili and Peru in 1880. In 1881 he was entertained at a public banquet and presented with a valuable ring by the staff of the Panama Canal Company in recognition of his services in an epidemic of yellow fever at Panama. In 1884–85 he served with the Royal Marines at Suakin and in the operations in the Eastern Sudan, being present at the battle of March 24th, 1885, and receiving the Egyptian medal with a clasp and the Khedive's bronze star. On September 13th, 1891, he was awarded a Greenwich Hospital pension.

ALTHOUGH Dr. WILLIAM BOOTH of Edinburgh retired from active practice some ten years ago, he was until quite recently often to be seen in the south side of Edinburgh, and he continued to minister to the needs of a small number of his former patients who were his personal friends. He was the fourth son of the late Rev. Patrick Booth, M.A., minister of Innerleithen. In his early years he spent some time at sea, and he was consequently a little more senior than most students when he took the L.R.C.P. and F.R.C.S.Edin. in 1886. He acted for a time as demonstrator in anatomy at the College of Surgeons and as medical officer at the Provident Dispensary, Marshall Street, Edinburgh. He built up, and until his retirement he carried on, a large private practice. He became a member of the Edinburgh Medico-Chirurgical Society in 1888, and a Fellow of the Edinburgh Obstetrical Society in 1891. He died at his house, 2, Minto Street, on May 7th, and was buried in the Grange Cemetery on May 10th. He was in his 63rd year, and he leaves a widow.

DEPUTY SURGEON-GENERAL JAMES FAIRWEATHER, Bengal Medical Service (retired), died at Forest Hill, Beaumont, Jersey, on April 29th, aged 88. He was born on October 19th, 1828, the son of James Fairweather of Brechin, and was educated at Edinburgh University, where he graduated M.D. in 1851, taking the L.R.C.S.Edin. in the same year. He entered the I.M.S. as assistant surgeon on August 4th, 1855; became surgeon on August 4th, 1867; surgeon-major on July 1st, 1873; brigade-surgeon, when that rank was first instituted, on November 27th, 1879; and retired with a step of honorary rank on October 19th, 1886; also receiving one of the extra compensation pensions in the first year when these pensions were given. He served on the North-West Frontier of India in the Bozdar campaign in the early part of 1857, receiving the frontier medal with a clasp; and in the Indian Mutiny in 1857–58, when he took part in most of the big fighting, including the siege and capture of Delhi; the actions of Bulandshahr, Aligarh, and Agra; the relief of Lucknow; the defeat of the Gwalior contingent at Cawnpore; the action at Shamshabad; the siege and capture of Lucknow; the action at Aliganj, and capture of Bareilly, receiving the Mutiny medal with three clasps.

DR. JOHN KEARSLEY MITCHELL of Philadelphia, son of Dr. Weir Mitchell, died on April 10th, at the age of 57. He graduated in arts at Harvard in 1880, and in medicine at the University of Pennsylvania in 1883. He was at one time lecturer on medicine in the medical school of that university, and for many years he was physician to the Philadelphia Orthopedic Hospital and Infirmary for Nervous Diseases. He collaborated with his father in the well-known work entitled *Fat and Blood*. In 1895 he published a monograph on the remote consequences of injuries of nerves, and in 1904 one on mechano-therapy, massage, and physical education.

PROFESSOR DOMENICO DI SANDRO, lecturer on pathology and clinical medicine in the University of Naples, was killed recently in a railway accident near Padua while on his way home from the front for a short period of leave. He held the rank of captain in the medical service of the Italian army. He was the author of many writings, among which may be mentioned researches on micro-organisms in the faeces of the subjects of oxaluria which transform carbohydrates into oxalic acid.

DIOSCORIDE VITALI, formerly professor of pharmaceutical chemistry in the University of Bologna, has died at Venice at the age of 85. He began life as a pharmacist at Piacenza, his native place; in 1859 he fought under Garibaldi and Bixio. After the peace of Villafranca he became director of the dispensary of the Piacenza Hospital, and on the death of Francesco Selmi was appointed professor of pharmaceutical chemistry at Bologna. He was greatly appreciated as a teacher by generations of pupils and gained a high reputation as an investigator. He was the author of more than two hundred publications embodying the results of original research. Among them are studies on the crystals of the blood, on blood stains, on bile acids and pigments in the urine, and on acetone.

Medical News.

MR. S. W. WOOLLEY has succeeded Mr. Peter MacEwan as editor of the *Chemist and Druggist*.

DR. J. B. MENNELL, who is in charge of the massage department of the Military Orthopaedic Hospital, Shepherd's Bush, has written a book on massage which will shortly be published by Messrs. J. and A. Churchill.

THE Marquis of Crewe, as chairman of the London County Council, appeals on behalf of the Children's Country Holidays Fund, 18, Buckingham Street, Strand, W.C. Reports show that there are many children for whom nothing but a country holiday can be prescribed, and who, lacking this, will suffer in health throughout the year.

AT the Brighton Grove Military Hospital, Newcastle-upon-Tyne, Lieutenant-Colonel R. A. Bolam, R.A.M.C. (T.F.), concluded on May 20th a course of six lectures and clinical demonstrations on venereal diseases to medical practitioners. Dr. Hudson subsequently presented a silver salver to Colonel Bolam in the name of fifty-five subscribers and spoke of the appreciation of those present of the value of such lectures and demonstrations, especially when given by a teacher of so much experience and power.

THE Association of Municipal Corporations has considered the proposal to form a Ministry of Health, and at the next meeting of the Council of the Association on June 14th a resolution will be proposed to the effect that inasmuch as the care of the public health calls for the exercise of wide powers of local government touching the lives of the people at many points, and involving questions not only of public medicine, but also of engineering, economics, and finance, any further consolidation, or expansion, of public health powers should be obtained by development of the present organization, and the recognition of the Local Government Board as the central public health department.

THE twenty-first annual meeting of the Asylum Workers' Association was held on May 14th at the Mansion House, with the Lord Mayor in the chair. The Lord Mayor laid stress upon the claim to public sympathy and appreciation of those ministering in asylums, a point further enlarged on by Cardinal Bourne, by Bishop Ryle, and by Sir G. Wyatt Truscott. In proposing the re-election as President of Sir John Jardine, Bt., M.P., Sir J. Crichton-Browne referred to the better realization by the nation of the value of its hospital nurses, and trusted that this appreciation might be extended also to mental nurses, whose work for the community, if less in evidence, was equally valuable and often more trying. Sir R. Armstrong-Jones spoke of the improvements in asylum nursing arrangements within his own experience, and Sir George Savage of the improved status of the asylum nurse. Sir Frederick Needham emphasized the present call for food economy in asylums, and Dr. Hubert Bond supported the claim to recognition of duly trained mental nurses in any scheme for the State registration of nurses generally. Owing to Dr. Farquharson Powell's absence on active service, Dr. G. E. Shuttleworth is again acting as honorary secretary of the association.

THE Ivory Cross is the name now adopted by the National Dental Aid Fund. Thanks to the patriotism of the dental profession, who gave their services on a hospital basis and have consented again to do the same, 15,000 men were treated, and two thousand sets of artificial teeth were supplied by the Soldiers' and Sailors' Dental Aid Fund, at a cost of £6,000, the office expenses being less than 4½ per cent. The War Office and the Admiralty having now made their own arrangements for the overseas armies and the Royal Navy, the National Dental Aid Fund, under its new name, intends to carry on similar work for men discharged from the services, for the home army, the mercantile marine, and the necessitous poor, including mothers and children. A public meeting will be held at the Mansion House, London, on Tuesday next at 3 p.m., under the presidency of the Lord Mayor, to help the development of this new work. Among the speakers announced are Lieutenant-General Sir Francis Lloyd, K.C.B., General Officer Commanding the London District; Sir Arthur Newsholme, Medical Officer to the Local Government Board; Sir StClair Thomson, Miss Lilian Braithwaite, and Miss Irene Vanbrugh.

THE third part of the first volume of a review of current Japanese medical literature by the staff of the research department of the Severance Union Medical College, Seoul, Korea, issued by the director, Dr. Ralph G. Mills, contains an abstract of a paper by R. Inada, Ito, Hogie, Ido, and

Oagika on a preventive serum for *Spirochaeta icterohaemorrhagiae* which appeared in *Saikin Gaku Zasshi*, the Japanese journal of bacteriology (No. 247, 1916). Milk containing spirochaetes in the proportion of ten organisms to the field was treated with carbolic acid to make a 0.5 per cent. solution, and the supernatant fluid, after centrifugalization, was injected into marmots. For injection into the human subject the amount was thirty times as great, and doses of 0.5, 1.0, and 2.0 c.cm. were injected within five days. The serum was found to have a weak immunizing action after ten days. Serum from marmots immunized with a mixture of highly immune horse serum 0.01 c.cm. and milk culutre (ten organisms to the field) 1.0 c.cm. was used for treatment at intervals of five to six hours until a total of 60 c.cm. had been injected. In the first 35 cases the serum from convalescent patients was found to be very effective in sterilizing the blood early in the disease. This work may be regarded as an extension of the researches of certain other Japanese investigators to which reference was made in the BRITISH MEDICAL JOURNAL of February 17th last, on page 230. In a paper on rat-bite disease (*Ji Kwa Zasshi*, the Japanese journal of paediatrics, No. 191, 1916), D. Koshira states that the cause was found to be a spirochaete to which the rabbit is particularly susceptible and which gradually loses its virulence by frequent passage through animals. As the result of clinical observation and animal experiment he has found that the Wassermann reaction is usually present and that the ulceration is curable by neo-salvarsan.

Letters, Notes, and Answers.

AUTHORS desiring reprints of their articles published in the BRITISH MEDICAL JOURNAL are requested to communicate with the Office, 429, Strand, W.C., on receipt of proof.

THE telegraphic addresses of the BRITISH MEDICAL ASSOCIATION and JOURNAL are: (1) EDITOR of the BRITISH MEDICAL JOURNAL, *Aitiology, Westrand London*; telephone, 2631, Gerrard. (2) FINANCIAL SECRETARY AND BUSINESS MANAGER (Advertisements, etc.), *Articulate, Westrand London*; telephone, 2630, Gerrard. (3) MEDICAL SECRETARY, *Mediseera, Westrand London*; telephone, 2634, Gerrard. The address of the Irish Office of the British Medical Association is 16, South Frederick Street, Dublin.

The address of the Central Medical War Committee for England and Wales is 429, Strand, London, W.C.2; that of the Reference Committee of the Royal Colleges in London is the Examination Hall, 8, Queen Square, Bloomsbury, W.C.1; and that of the Scottish Medical Service Emergency Committee is Royal College of Physicians, Edinburgh.

☞ *Queries, answers, and communications relating to subjects to which special departments of the* BRITISH MEDICAL JOURNAL *are devoted will be found under their respective headings.*

ANSWERS.

SPHAGNUM MOSS DRESSINGS.

IN reply to a question by "Commandant" as to the mode of use of sphagnum moss dressings, Lieutenant-Colonel Charles W. Cathcart, F.R.C.S., R.A.M.C.(T.), writes from the Edinburgh War Dressings Supply, 37, Palmerston Place, Edinburgh: These dressings are specially useful for wounds which suppurate freely. In such wounds the best results will be obtained when the moss is applied damp. A thin layer of gauze is wrung out of a warm antiseptic lotion and laid on the wound; over this, and overlapping it freely, are placed the damp bags of moss, in number as required. After each bag has been wrung out of the warm lotion the contained moss must be lightly opened out with the fingers; this is done easily owing to the elasticity of the material. Lastly, the bags are held comfortably in position with a bandage. This treatment of the moss bags is recommended whether the dressings are in the loose or compressed form, and whether they have been sublimated or sterilized by steam. The method has given great satisfaction at the Edinburgh War Hospital, Bangour.

LETTERS, NOTES, ETC.

STIGMATIZATION AND SUGGESTION.

DR. JOHN REID (London, W.C.) writes, with reference to the paragraph under this head, published May 26th, p. 691: As no doubt St. Francis's mind was ever dwelling on the wounds on His hands and side, it requires no great stretch of the imagination to place the so-called stigmata to unconscious acts during sleep or reverie.

RHUBARB LEAVES.

DR. WILLIAM BRAMWELL (Liverpool) points out that a very slight knowledge of the processes of assimilation and metastasis in plant life would show that the chemical constituents of root, stem, or leaf may so differ that the public should be warned against making experiments in their diet with any parts of vegetables which are not recognized foodstuffs. He endorses Dr. Tebb's reference in the JOURNAL for May 19th, p. 668, to the possibility of washing soda rendering oxalates soluble in the process of cooking. In view of this chemical action it would, perhaps, be unsafe to eat rhubarb or tomatoes at a meal which included cabbages or peas boiled with soda. Dr. Bramwell recalls that in the JOURNAL of November 22nd, 1902, and May 20th, 1916, he drew attention to the toxic effects of spring rhubarb.

GLYCERIN OF BORIC ACID, *B.P.*

MR. GEORGE LUNAN, F.C.S., pharmaceutical chemist (Edinburgh) writes: This is not a glycerin of boric acid but a glycerin of glyceryl borate. In view of the proposal to eliminate it from the *B.P.* on account of the want of added antiseptic power from the glycerin solvent property, it would be well to bear in mind its chemical composition and its consequent therapeutic properties when applied to mucous surfaces. Glycerine of glyceryl borate is decomposed into glycerin and nascent boric acid, which from concentration is precipitated, and in contact with albuminous surfaces yields the at least partial colloidal activity of the antiseptic. By no other solvent means can this be attained when exhibited in a throat paint. While not disputing the relative potency of boric acid as an antiseptic when dissolved in comparatively weak solutions of water or glycerin, it should be borne in mind that the formula for glycerin of boric acid in the *B.P.* is constructed for the special purpose of the reaction, and this entirely nullifies theoretic antiseptic values for germicidal purposes.

MEDICAL ECONOMIES.

A RESPECTED correspondent alleges that the following lines were recently rediscovered in a Mesopotamian *tel*. The date, he admits, is uncertain, but the analogies are sufficiently modern to make us doubt the strict accuracy of his covering letter.

Simples Simplified.

(Report by the —— Hospital Staff on War Emergency.)

Surgeon:
To save a limb, to save a life,
Needs no elaborate machine;
I'll manage nicely with a knife
And Iodine.

Physician:
'Twixt life and death to bridge the gulf
Were many drugs, but if you mean
To cut them down, leave me Mag. Sulph.
And some Strychnine.

Obstetrician:
I'll sally forth without a fuss
At dawn or dusk or in between
If only I've my forceps *plus*
Pituitrin.

Anaesthetist:
This latest plan of war reform
Brings me a chance quite unforeseen,
I'll toddle round with chloroform
And Tab. Morphin.

Ophthalmologist:
An ophthalmologist can cope
With eyesores of the great and mean
When armed with an ophthalmoscope
And atropin.

Rhinyngotologist:
I'll manage ears and throats and noses
More deft than I have ever been,
With forceps, speculum, and doses
Of cocain.

Dermatologist:
I'm not at all ashamed to state
My only drugs have always been
Just Ung. Hydrarg. Ammoniat.
And paraffin.

Omnes:
And should the last of drugs and grub
Find bottom through the submarine,
Is there aught else? Ay, there's the rub,
And Nicotin.

T. P. B.

Mesopotamia Expeditionary Force.

SCALE OF CHARGES FOR ADVERTISEMENTS IN THE BRITISH MEDICAL JOURNAL.

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